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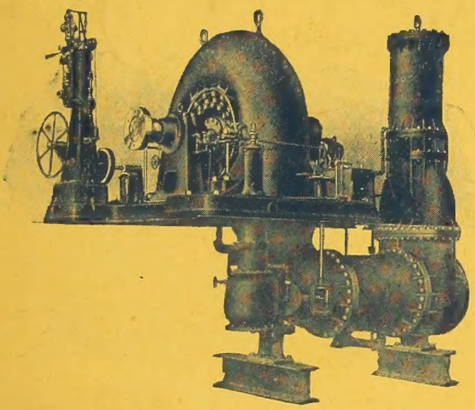
Southam

Vol. XXII—No. 1 Toronto, January 1, 1913

Electrical News

Generation, Transmission and Application of Electricity



HYDRAULIC TURBINES

One of three units each of
1700 H. P. at 720 R. P. M. 280 ft. Head

These wheels when tested in place gave over 87% efficiency.

We are now building five 16,000 H. P. units to operate under 600 foot head.

SEND FOR BULLETIN N

S. Morgan Smith Co., York, Pa.

Branch Offices: 167 Federal St., BOSTON, MASS
American Trust Bldg., CHICAGO

A SUGGESTION FOR THE COMING YEAR

SPECIFY

TRANSFORMERS
INSTRUMENTS
METERS
MOTORS
WIRING DEVICES
ARC LAMPS
CARBON LAMPS
MAZDA LAMPS

GENERATORS
SWITCHBOARDS
CIRCUIT BREAKERS
LIGHTNING ARRESTERS
RECTIFIERS
HEATING GOODS
WIRES AND CABLES
RAILWAY SUPPLIES

SUPPLIES

If your problem requires information based on a wide range of electrical manufacturing experience you will obtain this service through the co-operation of our nearest district office

Canadian General Electric Co., Limited

Head Office: TORONTO

Montreal Halifax Ottawa Cobalt South Porcupine Winnipeg Calgary Vancouver Victoria Nelson Prince Rupert

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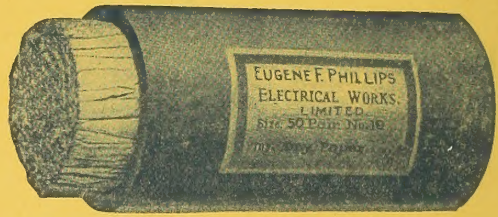
PHILLIPS

Bare and Insulated Copper

WIRES AND CABLES

For Telephone, Telegraph, Lighting,
Power and Street Railway Equipment



Bare and Insulated Electric Wire and
Cables for Aerial and Underground use

Railway, Feeder and
Trolley Wire

Weatherproof Magnet
and Rubber Covered
Wires and Cables

Incandescent and Flexible Cords

Eugene F. Phillips Electrical
Works, Limited

MONTREAL - - CANADA

Branches: Halifax, Toronto, Winnipeg, Vancouver

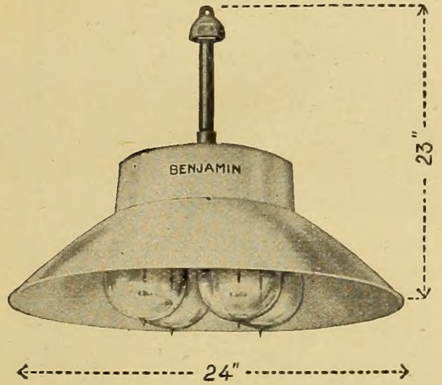
Light Your Curling and Skating Rinks

WITH

Benjamin Fixtures

FIXTURES—REFLECTORS—FITTINGS

for all indoor and outdoor requirements



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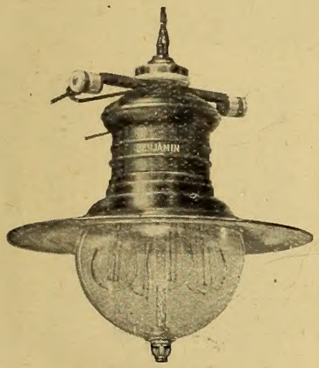

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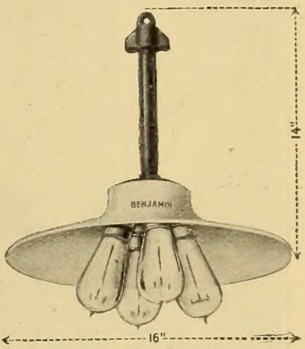
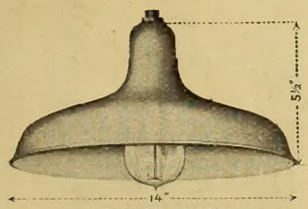


Cat. No. 6034

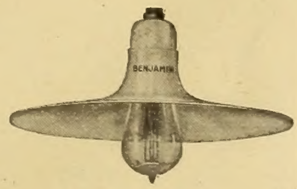
Send us a sketch of your rink and our engineering department will lay out a lighting system of

High Efficiency
Low First Cost
Low Maintenance



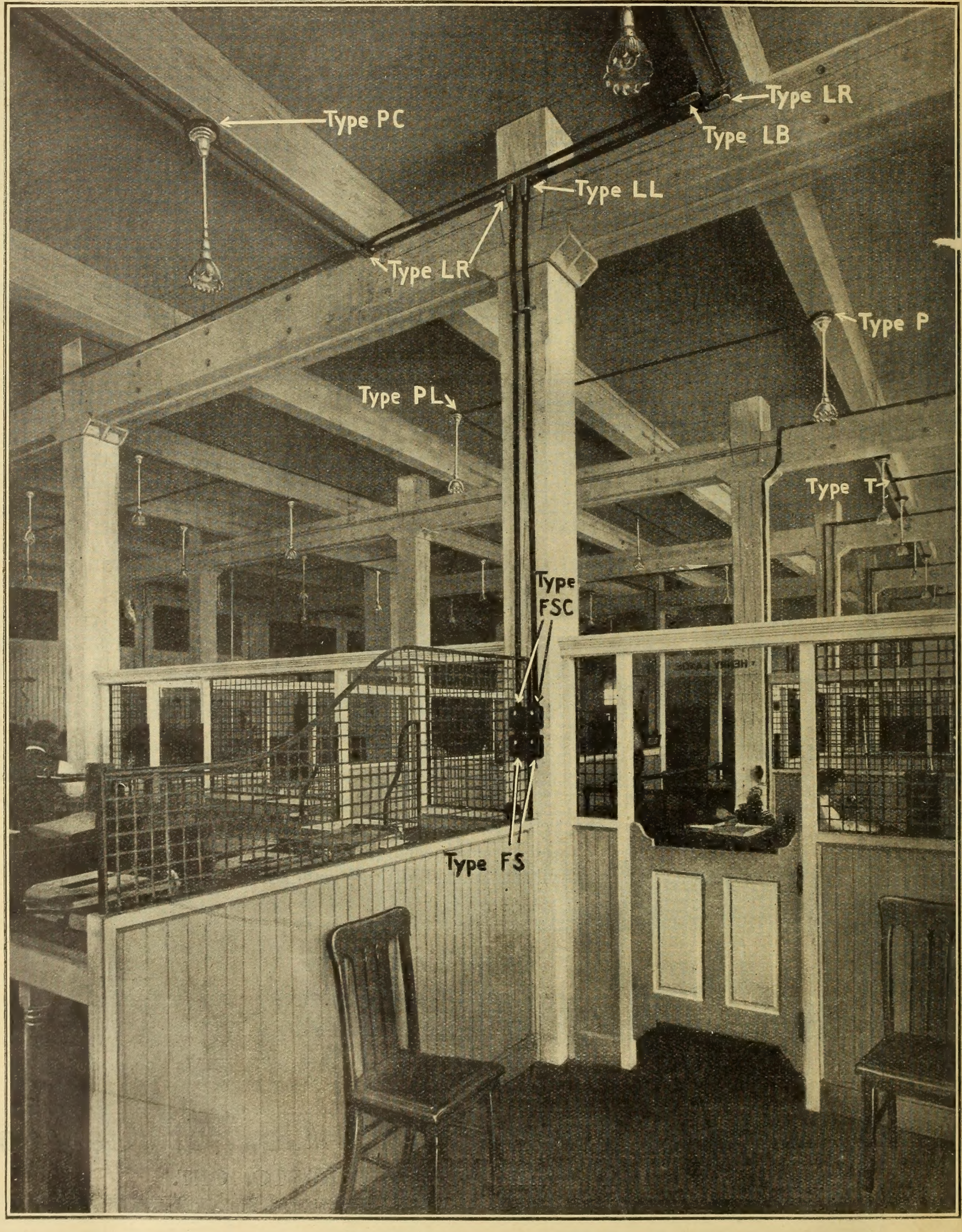
Cat. No. 5423

All Jobbers Sell "BENJAMIN"



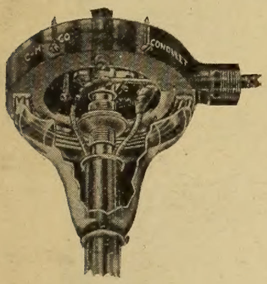
Cat. No. 5402

Benjamin Electric Mfg. Co., of Canada
Limited
11-17 Charlotte Street, TORONTO, ONT.


Type PC
Type LR
Type LB
Type LL
Type LR
Type P
Type PL
Type T
Type FSC
Type FS

Condulets Used in Installation Shown on Opposite Page

Each One the Best Possible form of Conduit Outlet for the Particular Requirement



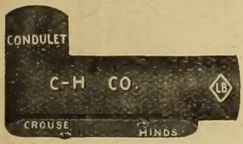
Type P—Arranged for Combination Gas and Electric Fixture

Type PC

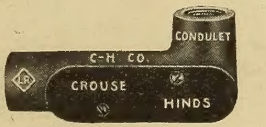
Type PL

The P series includes, besides the types shown above, types PA (single hub on back), PT (through feed, single branch) and PX (through feed, double branch).

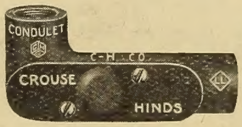
These Condulets can be used with electroliers, clusters and combination gas and electric fixtures, having canopies 4 to 6 inches in diameter.



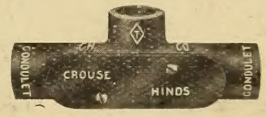
Type LB



Type LR



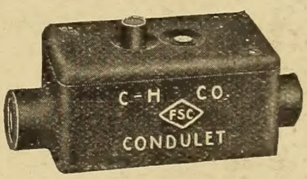
Type LL



Type T

Condulets immediately above are shown with blank metal covers. They also take any of seventeen other covers, including porcelain with one to eight wire holes, male and female nipples, and metal with male and female nipples.

Type FS



Type FSC

Type FS and FSC take flush rotary as well as the double push button switches shown here. Two styles of covers, one for each variety of switch, are interchangeable on these Condulets.

Over a hundred other types of Condulets—one for each Exposed Conduit need—are shown in Condulet Catalogs, Bulletins Nos. 100 and 101. Copies Free!

Order from your dealer. If he does not stock them, write us.

Crouse-Hinds Company of Canada, Limited

Main Office and Works:

Toronto, Ont., Canada

ADANAC Red Core Rubber Covered

WIRES & CABLES

RUBBER COVERED
TRADE
ADANAC
MARK
WIRES AND CABLES

Adanac Red Core Rubber Covered Wires and Cables

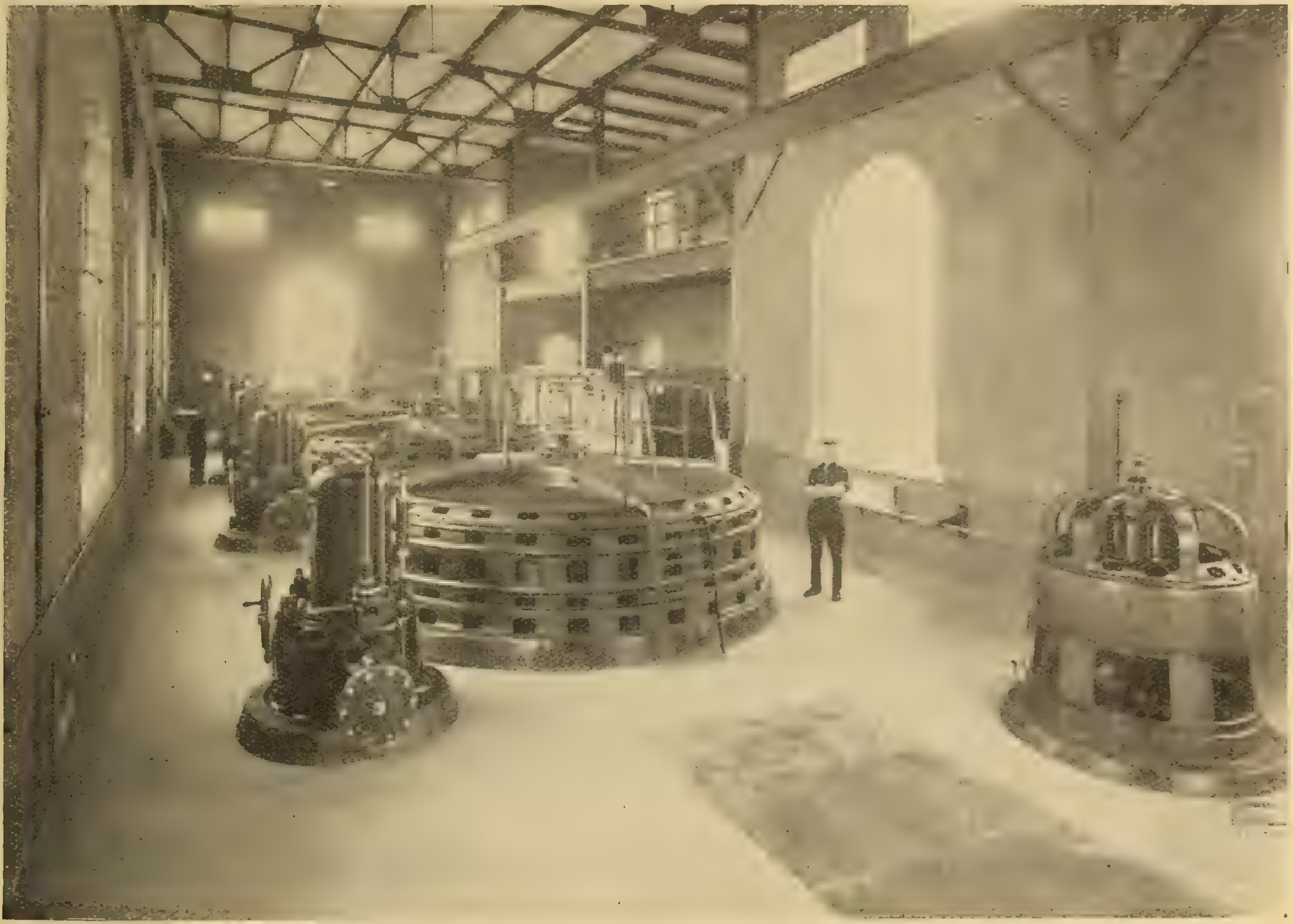
are made according to the specifications of the National Board of Fire Underwriters. The conductors are drawn from copper of the highest conductivity and are covered with two thicknesses of thoroughly vulcanized rubber compound of high quality. The wires are braided over insulation and the smooth high finish they receive makes them specially desirable for conduit work.

IMPERIAL
WIRE & CABLE
COMPANY
Limited
MONTREAL

THE Northern-Electric
AND MANUFACTURING CO. LIMITED
SALES AGENTS

TORONTO WINNIPEG
REGINA
CALGARY VANCOUVER

High Grade Electrical Apparatus



4-937½ K V A 6600 volt 3 phase 60 cycle 120 R P M Vertical Generators for Sidney Electric Co., Dam No. 2.
Duplicate plant now being installed.

Kilmer, Pullen & Burnham,
LIMITED

Head Office,
TORONTO

Branch Offices: MONTREAL
General Supplies Ltd.,
CALGARY, ALTA.

SOLE DEALERS FOR

The General Electric Co., of Sweden

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The Advertisements in the "Electrical News" represent the leaders in their line

Men Who Know Conduits

Invariably Specify

"Galvaduct" and "Loricated"

Fort Garry Hotel—Winnipeg. A Galvaduct Building

THE CONDUIT QUESTION?

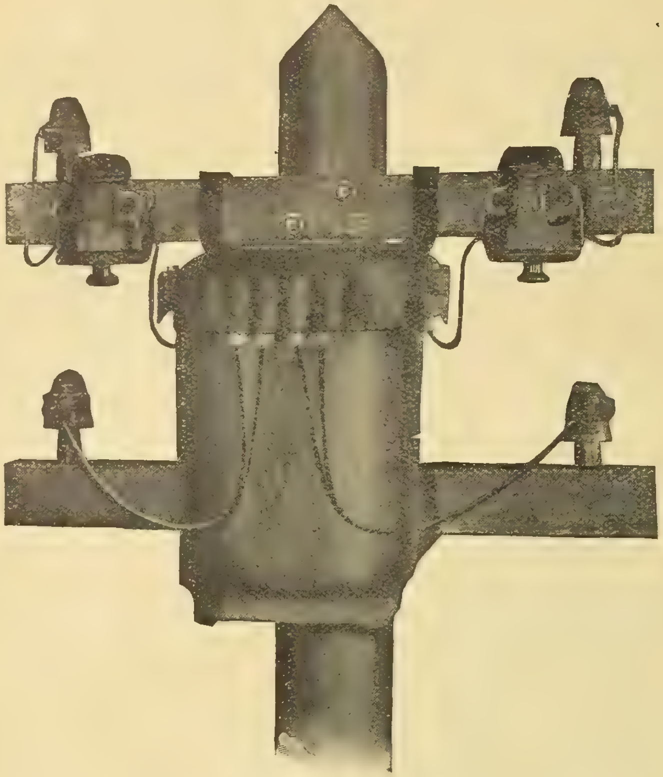
Every exacting engineer and architect is vitally interested in Conduits because the question of conduit protection is an absolute necessity in modern building and engineering practice.

We are prepared to submit convincing proof that **"GALVADUCT" and "LORICATED" Conduits** give longer life, better service, and more clearly meet the conditions for which they are made than any other conduits produced.

If your jobber cannot supply you, write us

Conduits Company Limited

Toronto and Montreal

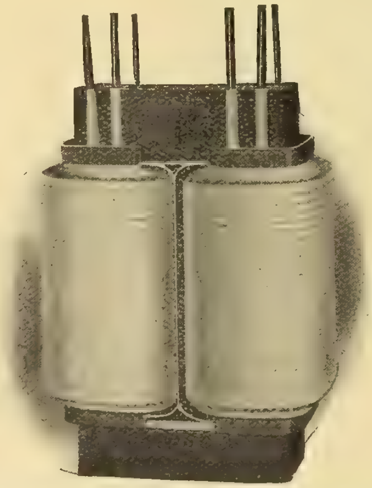


Moloney High Efficiency Transformer in position on pole showing method of wiring

High Commercial Efficiency

is the sum total of what is required in transformers—the knowledge that the current is not being wasted in transformation—that the core and the copper loss is low with a low temperature rise and a high and permanent insulation—that the construction is strong and the workmanship is faultless. All this is necessary and what is required in transformers. All this is what is given in the highest degree in

Moloney
High Efficiency Transformers



Interior view of Moloney High Efficiency Transformer

Before you decide on the purchase of transformers let us figure out some transformer costs for you. Let us **show you how** Moloney transformers effect a **direct saving** over any other method on account of their high-commercial-all-day-efficiency.

Write for new catalogue giving full data and all information

Canadian Moloney Electric Co., Limited

Office and Works: WINDSOR, ONT.

COMPLETE STOCKS:
WINDSOR WINNIPEG VANCOUVER

NULITE

(REGISTERED)

Have you seen it?

The wonderful new Tungsten Lamp that you may handle as you would a Carbon Lamp. Pure Tungsten Drawn-Wire, Continuous Filament. Insist on having the NULITE

Standard

of the lamp world—place your contract *now* and protect yourself in the matter of price.

Manufactured in Canada by

The Canadian Tungsten Lamp Company
Limited
HAMILTON - - - ONTARIO

Warehouses at: MONTREAL TORONTO WINNIPEG VANCOUVER

BANNER TRADE MARK

"Banner"
TRADE MARK

BANNER TRADE MARK

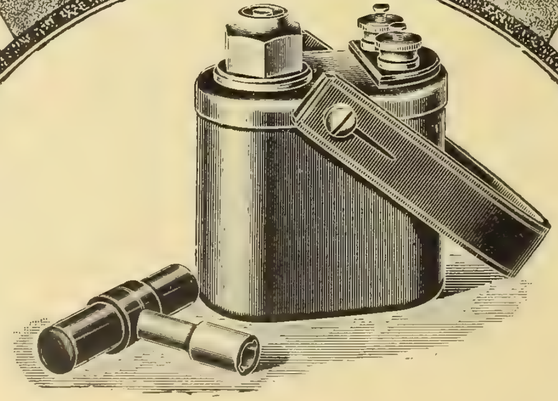
Lighting Fixtures

Write to us for the latest designs in "up-to-date" electric fixtures.

Fixtures made from original drawings on short notice.

Ontario Lantern & Lamp Co., Limited,
HAMILTON, CANADA.

STERLING TELEPHONES
BRITISH MADE
STRONG & RELIABLE



No. C2599

Electric Blasting Machine
to Fire Two Shots
Weight 3½ lbs.
Drawn Brass Case
Detachable Handle
British Made

AGENTS (*with Stock*)
MANITOBA
The James Stuart Elec. Co.
Winnipeg Limited
ONTARIO
Chapman & Walker, Limited
Toronto
SASKATCHEWAN
Northwestern Electric, Ltd.
Regina
BRITISH COLUMBIA
Cope & Sons
527 Dunsmuir Street, Vancouver
ALBERTA
General Supplies, Limited
1233 2nd Street East, Calgary

QUEBEC—*Stocks kept by*
Dawson & Co., Limited - - Montreal
Mechanics Supply Co.,
St. Paul, Quebec (Que.)
NOVA SCOTIA—*Stocks kept by*
J. Starr, Son & Co., Limited, Halifax

Announcement
of the
Standard Underground Cable Co.,
of Canada, Ltd.

WE take this opportunity to wish you a Happy and Prosperous New Year and to thank you for the generous support which you have accorded us during the first eight months of our manufacturing experience in the Dominion, in the shape of substantial orders. 15

The steady increase and aggregate value of these orders is, we believe, conclusive indorsement of our policy of *high quality* and *fair dealing* which has, for a third of a century, always been associated with "Standard" Products.

We solicit your patronage during 1913 for the following

"Standard" Products

- Wire Rods
- Bare Wire and Cable
- Standard C. C. C. Wire (Colonial Copper Clad)
- Magnet Wire
- Weatherproof Wire
- Rubber Insulated Wire
- Varnished Cloth Cable (Varnished Cambric)
- Fibre Insulated Leaded Cable
- Dry Paper Leaded Cable
- Saturated Paper Leaded Cable
- Rubber Lead-Covered Cable
- Armored Cable
- Cable Terminals
- "Ozite" Insulating Compounds
- Insulating Tapes and Sheets
- Insulating Varnishes
- Cable Hangers and Supports
- Cable Installations

Detailed information, samples, estimates or prices cheerfully furnished in regard to any of the products in the above list which is only an outline of our complete list.

Our engineers have had long experience in the installation of cable systems of all kinds and they will gladly advise you regarding your problems in this line.

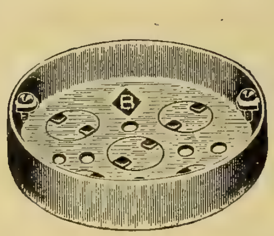
Standard Underground Cable Co., of Canada, Limited
Hamilton, Ont.

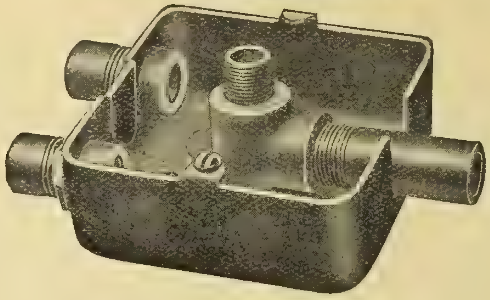
Montreal
Boston

Winnipeg
Seattle

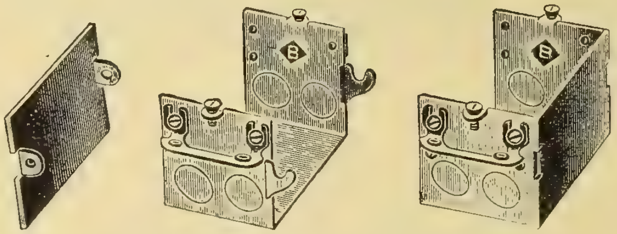
MADE IN CANADA

Conduit Boxes, Conduit Pipe Fittings, Conduit Accessories, &c.

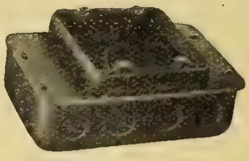


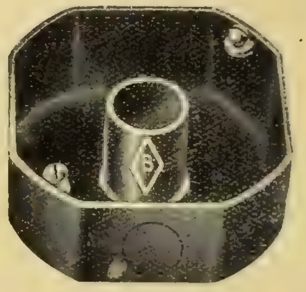


ALPHADUCT
FLEXIBLE CONDUIT
TRADE MARK
FOR ELECTRIC WIRES



Type S C 3" deep—C C S-2" deep
side comes off and does away with carrying two gangs





Write for Catalogue No. 4

Electrical Fittings Co., Limited

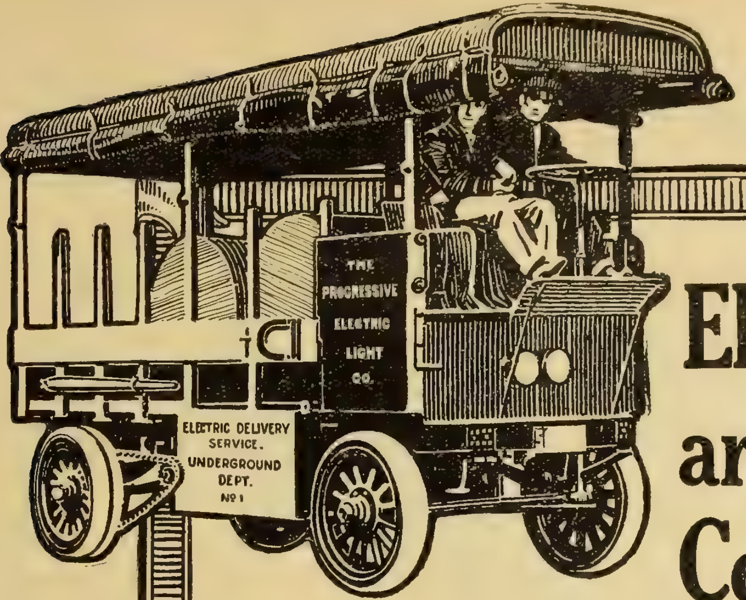
Write for Catalogue No. 4

70 King St. West - Toronto - Canada

STOCKS CARRIED BY
Cope and Son, Ltd., 132 Water St., Vancouver, B. C.
Munderloh & Co., Ltd., Victoria Sq., Montreal.

If your jobber cannot supply you, write us. We carry a large stock at Toronto Warehouse and Guelph Factory.

STOCKS CARRIED BY
The Mainer Electric Co., Ltd., 61 Albert St., Winnipeg, Man.
John Starr, Son & Company, Ltd., Halifax, N. S.


THE PROGRESSIVE ELECTRIC LIGHT CO.
ELECTRIC DELIVERY SERVICE. UNDERGROUND DEPT. No 1

Electric Trucks are best for any Central Station

—most efficient and most economical

The Central Station that does not use Electric Trucks is overlooking a big factor for its own betterment. Electric Trucks are most perfectly adapted to the outdoor work of electric lighting companies. They are power plants on wheels—ready always to do their work cheaper, better and quicker than any other type of vehicle. Here are some of the uses to which any Central Station can adapt Electric Trucks:

1. **General hauling of all kinds.**
2. **The hauling of heavy material, such as transformers, reels of cable, etc., in which the electric winch is indispensable.**
3. **The application of the electric vehicle in the construction of aerial lines, where electrically operated cranes are used for erecting or removing poles, transformers, etc.**
4. **The use of the electric vehicle in underground work for the drawing in and out of cable and pumping out of manholes.**
5. **The use of the electric tower wagon for trimming of arc lamps, etc.**
6. **The adaptability of the electric vehicle as an advertising medium.**

Small electric wagons are used by many companies for the delivery of lamps, meters, etc. These wagons are equipped with crates, etc., and have excellent advertising value as well as giving efficient, economical service.

Your use of Electric Trucks recommends them to others

Once the vehicle users in your locality see that you have confidence in Electric Commercial Vehicles, it will be easy to induce them to follow your lead. Of course, you know the value of a vehicle charging business in making off-peak hours profitable. Why not boost Electric Vehicles with this end in view?

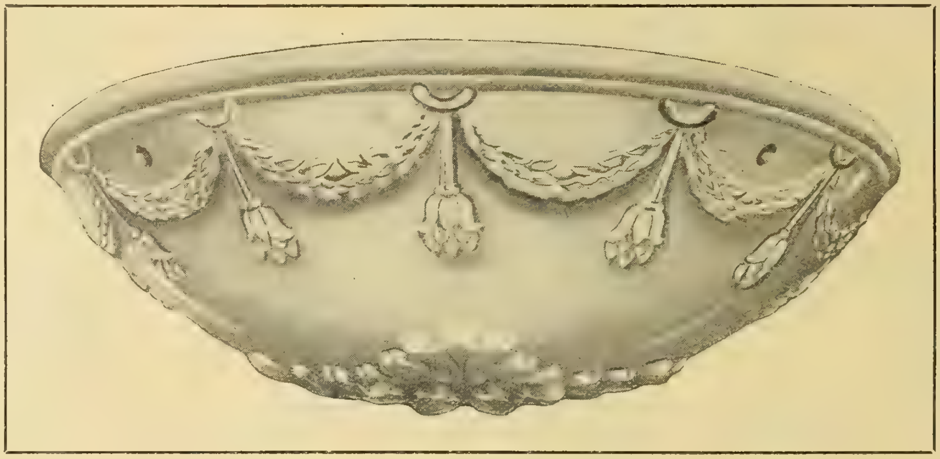
We are conducting a nation-wide advertising campaign on behalf of the Electric Vehicle—pleasure and commercial—in 36 standard magazines and trade journals. We will gladly show you how you can make this national advertising of immense individual benefit to your Central Station. For full particulars write today.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA

BOSTON NEW YORK: 124 W. 42nd St. (31) CHICAGO

Luceo and Moonstone Glass

MADE IN CANADA

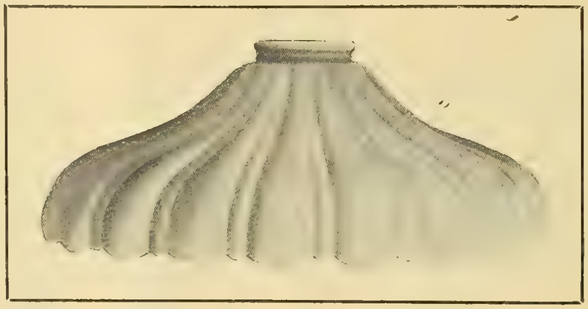


No. 6030. Luceo Semi-Indirect Bowl

One of the newest and most popular light units is the semi-indirect bowl. It is decorative and ornamental as well as efficient, and is rapidly replacing many installations in the home and office.

We manufacture many special designs of these bowls along with our regular line of Luceo and Moonstone Shades and Reflectors.

Street lighting glassware a specialty.



No. 4038. Luceo—100 Watt

No. 4010. Luceo—60 Watt

Full particulars on request. ***Write us your requirements.***

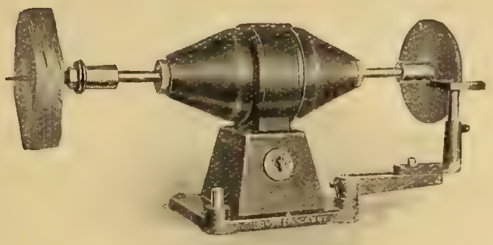
The Jefferson Glass Company Limited

MADE IN CANADA

TORONTO CANADA

Holtzer-Cabot

Buffing Motors
Grinding Motors



Note

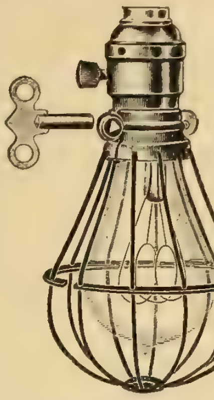
1. The snap switch for starting
2. The gasketed joints
3. The shaft supported by long bearings
4. The adjustable tool rest
5. The lots of room around the wheels

For Direct, Single or Polyphase

The Holtzer-Cabot Electric Co.
Boston - Chicago

ONE LAMP SAVED PAYS THE COST OF A

LOXON
LAMP GUARD
THE KEY TO SAFETY



And every Loxon saves many lamps during its life. It's an investment of assured dividends—no guess work—it pays for itself and then pays big returns.

If you have unprotected lamps in your plant, exposed to Breakage and Theft, you should lock every one into the socket with a Loxon which fastens on with a key and

Performs the Double Service of Preventing Theft and Breakage

Don't put it off—delay means more useless waste. Loxons are made for Mazda as well as Carbon lamps.

Carried by Most Canadian Electrical Dealers

McGill Mfg. Co., 5 Oak Street, Valparaiso, Ind.

Special Notice to the Trade

¶ Our Fall catalogue has been considerably delayed owing to the many new designs which we have been making. The printer promises same will be in our hands within the next few days, and we wil immediately begin distributing same.

¶ This catalogue will cover a very wide range of handsome and inexpensive fixtures, both of the direct and semi-indirect type. Included in same will be several designs using the ever popular effective candlestick to its best advantage. Also a nunber of fixtures adapting crystal decorations.

¶ We have not overlooked the use of leaded glass in Dining Room Domes, Hall Lanterns and several very handsome portables.

¶ We are very anxious that all the trade, as well as those interested in the better grade of fixtures, should receive this catalogue, therefore to be sure that you get a copy send us your name and address at once.

The Tungstolier Company
of Canada, Limited
HEAD OFFICE: **212 King St. West, TORONTO**

Protection from Lightning Troubles

The following list of users will speak for itself:

- Victoria Falls and Transval Power Co.
- Shanghai Municipality.
- Melbourne Electric Supply Co.
- Cleveland and Durham Power Co.
- St. John Del. Key Co., Brazil.
- Societa Dergano.
- Sociedad Espanola, Madrid.
- Societa Electrica Suburbana, Milan. &c.

Lightning, if unchecked, will break the windings of your apparatus, blow out your fuses and break down your transformers.

In short, lack of adequate and capable lightning protection may mean to you serious loss of time, money, and perhaps lives.

A host of so-called lightning arresters are on the market, but 99 per cent. of them are valueless because the principle on which they are constructed is wrong.

High frequency—not high voltage—is the cause of the damage done by lightning.

Most protective systems work on the principle that high voltage is the cause of the damage. This is incorrect, hence their uselessness.

A lightning protection apparatus to be of any use **must offer a clear path to earth for high frequency currents independent of voltage.**

Our apparatus is absolutely the only one that fulfills this condition.

Our principle is correct, our design is the best and our guarantee absolute.

If you are having trouble with your protection or are about to install — write, call or phone us. We will be glad to advise, estimate or install for you the very best and latest protective gear.

CHAPMAN & WALKER, ELECTRICAL ENGINEERS AND CONTRACTORS

69 Victoria Street, TORONTO

V. I. R. Cables

Wire, Flexible

Paper Insulated Lead Covered Cables

Telephone Cables

MONTREAL AGENTS:

Alexander Macpherson & Son,
Montreal, Que.

.075 sq. in. three core, circular lead covered, steel tape armoured cable

Vulcanized Bitumen Cables

Transmission Lines

Trailing Cables

TORONTO AGENTS:

Chapman & Walker, Limited
69 Victoria Street
Toronto, Ont.

W. T. Henley's Telegraph Works Co.

Limited

Contracts taken for complete Cable Systems installed

Bare and Insulated

WIRES AND CABLES

in

Copper and Aluminum

RAILWAY FEEDER CABLES

in Copper and Aluminum

Copper Trolley Wire
Copper Clad (Duplex Metal) Wire
Galvanized Steel Strand for Guys

Canada Wire & Cable Co.

Limited

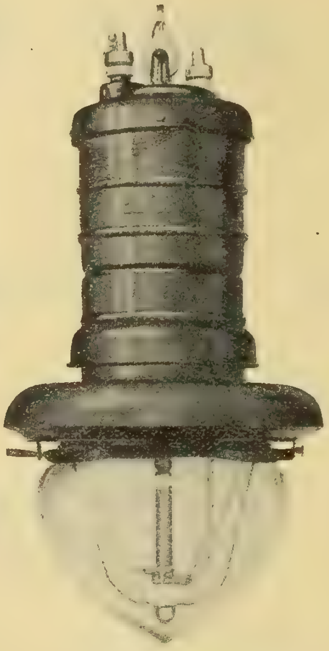
1170 Dundas Street, TORONTO

Stock of Wire and Cable Carried in Toronto, Montreal and Winnipeg

SALES AGENTS:
Roper, Clarke & Co. Limited, MONTREAL
A. E. Esling, Scott Block, WINNIPEG
Macdonald, Marpole Co. Limited, VANCOUVER
Messrs. Gorman, Clancy & Grindley, Ltd., WINNIPEG and EDMONTON

Flame Arc Lamps

LONG LIFE



New Type W

In construction work, railway yards, drill halls, warehouses, in fact everywhere where good, brilliant illumination is required over large areas this type of lamp is ideal.

The C.G.E. Flame Arc Lamps (Type W) are designed particularly for that purpose. The brilliancy of the widely diffused illumination from the lamp remains constant throughout its long electrode life.

The arc is steady and is always in the same focus from start to end of trim.

The electrode life is from 100-125 hours.

Trimming is very simple and only one carbon is renewed. Either a white or yellow light can be obtained as desired, depending on carbons.

The mechanism is simple and readily accessible. One noteworthy feature is the efficient clutch which is sensitive and positive in its action.

The casing is weatherproof and insect-tight. The C.G.E. Long Life Flame Arc Lamp is strongly and substantially built throughout. It is as reliable in operation as it is sturdy in construction. Send for full information regarding this economical and powerful lamp.

OVER 5000 NOW IN SERVICE

Canadian General Electric Co., Limited

Head Office: TORONTO

Montreal Halifax Ottawa Cobalt South Porcupine Winnipeg Calgary Vancouver Victoria Nelson Prince Rupert

The C. G. E. Ozonator

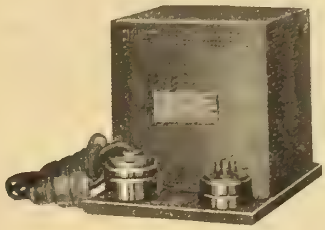
THE Ozonator is a device for destroying odours, poisons, infectious bacteria and purifying the air generally by Ozone produced electrically.

Hygienic conditions demand scientific sanitation and ventilation.

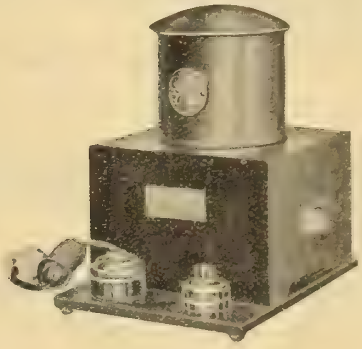
Ozone improves ventilation not by taking the place of fresh air but by destroying the foul and harmful organic substances that are ever present where people congregate. Ozone sterilizes the air and increases the activity of the oxygen component.

The C. G. E. Ozonator is used to great advantage and benefit in dwellings, halls, lodge-rooms, theatres, factories, etc. It is neat and compact, and can be attached to any electric light socket and consumes very little current.

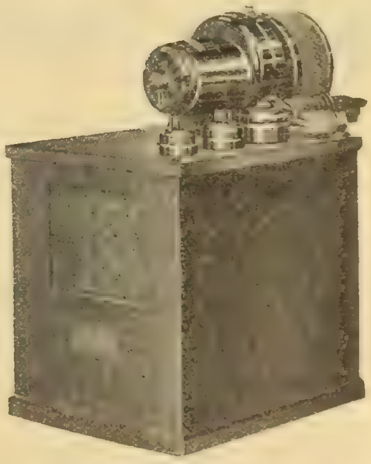
Write us for Booklet 506, giving further information regarding this new air purifying device.



UTILITY OZONATOR



HOUSEHOLD OZONATOR



UNIVERSAL OZONATOR

Canadian General Electric Co., Limited

Head Office: TORONTO

Montreal Halifax Ottawa Cobalt South Porcupine Winnipeg Calgary Vancouver Victoria Nelson Prince Rupert

C. & H. METERS

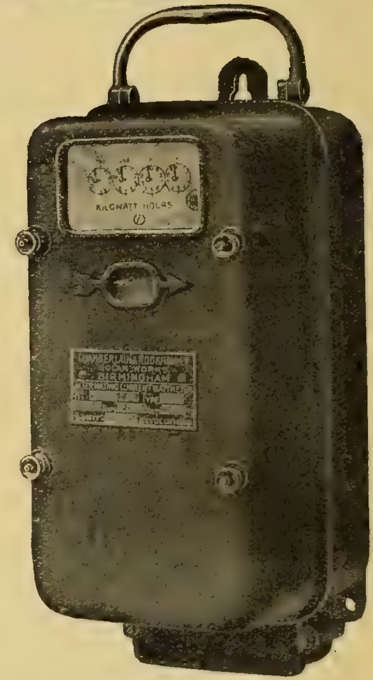
Our meter brings you in more dollars, WHY ? Because it starts on a smaller current and is more accurate over long periods than any other on the market today.

Write to us ***now*** and we will tell you why this is so, and what is more, prove it with goods.

The
Chamberlain & Hookham Meter Co.
Limited
312 Kent Building, TORONTO

Meter and Time Switch Specialists

Main 7791 Cables "Meters"



Polyphase Meter

The New Year is the Season of New Contracts

For some lines of goods it pays to contract, especially when you are protected against a raise in price and given the advantage of a reduction. We have special contracts, which we are sending out to our customers, covering :—

NEW CODE RUBBER COVERED WIRES AND CABLES
MAZDA TUNGSTEN AND CARBON LAMPS
COLUMBIA DRY CELLS
GALVANIZED AND ENAMELLED STEEL CONDUITS

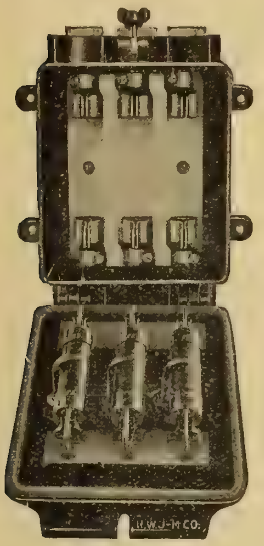
We maintain in Winnipeg heavy stocks of the above materials ready to ship to you the day your order is received. Our price is in line with the lowest market quotation. We give you the advantage of car load rates from factory to Winnipeg.

Write for copy of our special yearly contracts, and if you mention seeing this advertisement in the "Electrical News," we will send you one of our 1913 calendars.

The Mainer Electric Company, Limited
61-63 Albert Street, WINNIPEG, MANITOBA

No "Shorts"—No "Grounds"—No "Burn-Outs" with

"NOARK" SERVICE BOXES



FUSES OUT

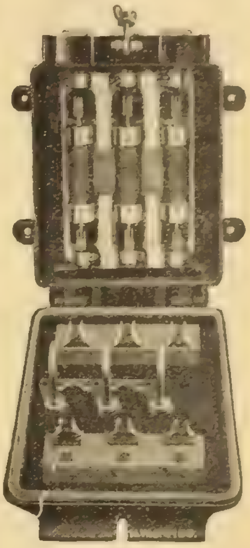
There is no danger of short-circuits, grounds or burn-outs when you use "Noark" Service Boxes, because they are made on the well-known "Noark" weather and water-proof principle, which prevents all water from reaching any live parts.

The cover can be opened without disturbing the fuses or breaking the circuit by the "Noark" fuse inspecting device. When you buy a "Noark" Service Box, you get two devices in one—a switch and a cut-out, and the Underwriters Laboratories have approved these boxes for this double service.

They can be used for conduit or open wiring and a complete line of interchangeable fittings are supplied for conduit construction work.

"Noark" Service Boxes are made in capacities of 0-30, 31-60, 61-100, 101-200 and 201-400 amperes, 2 and 3 poles for 250 and 600 volt service.

Write nearest Branch for Catalog 406.



FUSES IN

THE CANADIAN H. W. JOHNS-MANVILLE CO., LTD.

Manufacturers of Asbestos and Magnesia Products ASBESTOS Asbestos Roofings, Packings, Electrical Supplies, etc. 1315

TORONTO MONTREAL WINNIPEG VANCOUVER

Don't Wait — Write Now

for

DEVOE

New Switch Catalog giving full detail of Switches, Boxes and Panelboards

The Devoe Electric Switch Company

Office and Factory: 157 Craig St. West, Montreal

Do you realize the true signifigance of a Trade Mark?

It means that the manufacturer of trade marked goods is behind them "all along the line" with his guarantee as to quality.

TRADE DUNCAN MARK

This trade mark insures **"Duncan Quality"** in every electrical specialty or supply that carries it.

We emphasize it because we want you to be familiar with it and what it stands for—the best materials we can procure and the highest grade workmanship that it is possible to employ.

Have you a copy of our NEW catalog?

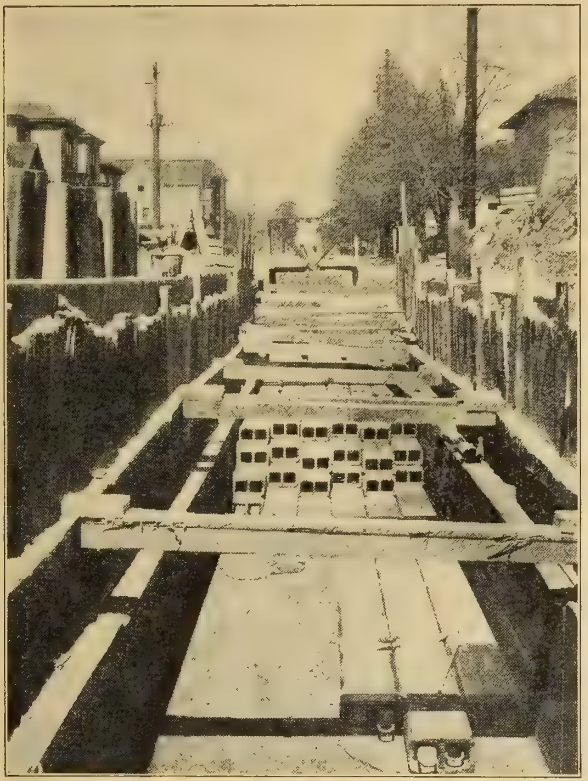
Duncan Electrical Co.

Limited

Montreal

G. M. GEST

Conduit Engineer
and Contractor



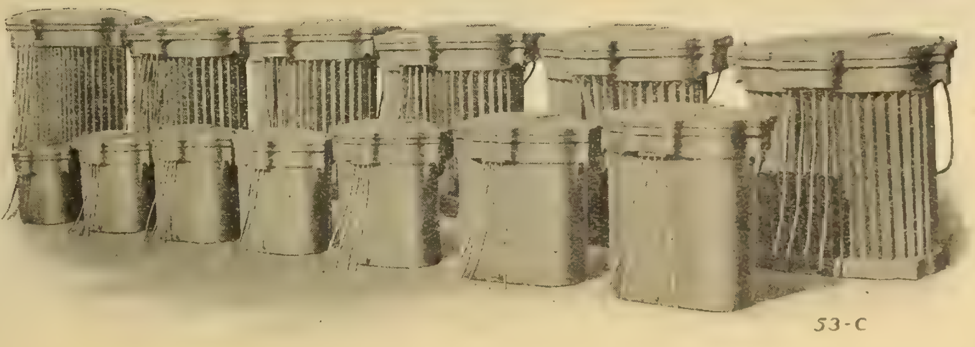
Electrical
Underground
Conduit
Systems

When **G. M. GEST** designs and constructs your Conduit System you receive the benefit of many years' experience and specializing in that line of work.

Power Building, Montreal, P.Q.

Crocker-Wheeler Transformers

A. C.
Induction
Motors
Generators
Transformers



D. C.
Motors
for all
classes
of work
Generators

A full stock of standard voltage distributing transformers in sizes 1 to 50 K.V.A. 60 to 25 cycle is on hand for immediate shipment. Communicate with us regarding your Fall and Winter requirements.

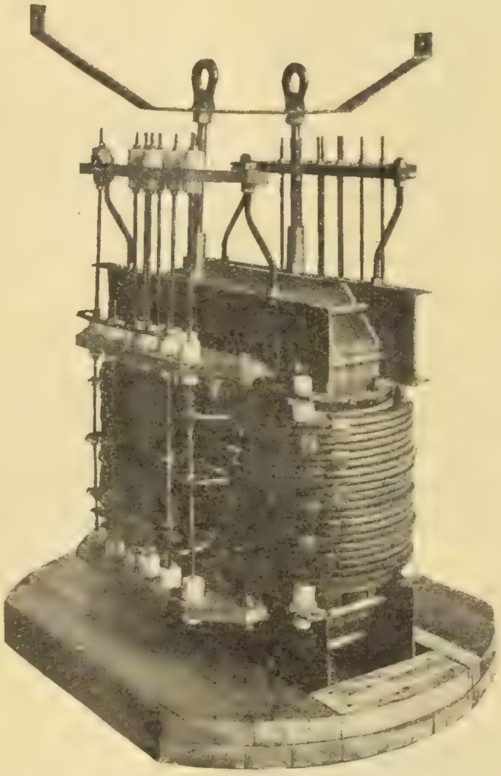
The Canadian Crocker-Wheeler Co., Ltd.

Manufacturers and Electrical Engineers

Head Office and Works:
ST. CATHARINES, ONT.

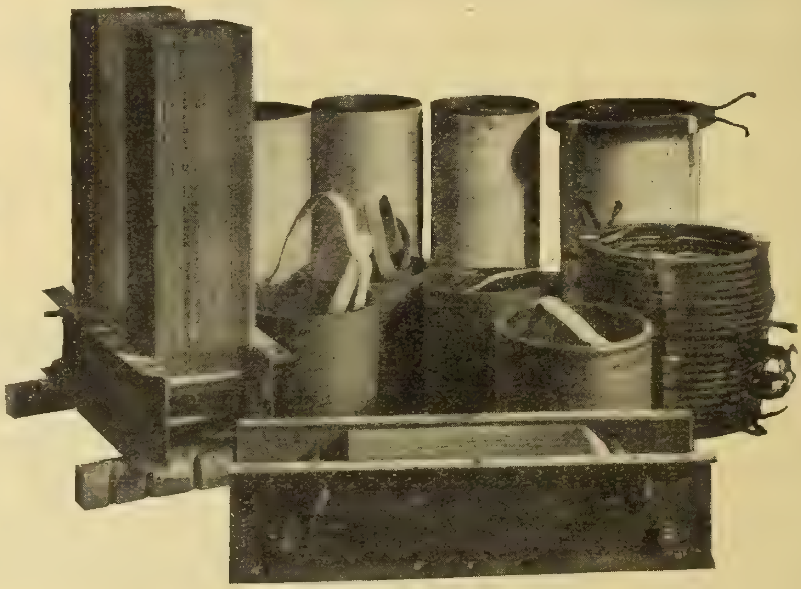
Branch Offices:
MONTREAL TORONTO VANCOUVER

Butt Joint Core Type Transformers



Note the arrangement for holding the core centred in the tank so that the transformer can be shipped complete in its case ready for immediate service.

Note also the strong mechanical arrangement of both H. V. and L. V. leads from coils to terminal board.



Note how easily the butt joint core type transformer is dismantled. The edges of punchings meet but do not overlap, and the top yoke can be quickly removed in case of injury to any of the coils.

Note the highly insulated H. V. coils so assembled as to expose the entire surface to the cooling oil.

Works - - - MONTREAL

ALLIS-CHALMERS-BULLOCK

LIMITED

Sales Offices: MONTREAL, Canadian Express Co. Bldg. TORONTO, Traders Bank Bldg.
WINNIPEG Builders Exchange Bldg. VANCOUVER, Dominion Bldg.
COBALT CALGARY

The Seven Essentials

which must **all** be present in every **successful** installation of indirect illumination.

(1) Most powerful reflectors *made*
to reflect the largest amount of light generated by the lamp against the ceiling, thus attaining the desired brightness in the illumination of the room at minimum cost for current.

(2) Reflectors of *scientific* design
to direct the light rays against the ceiling at the proper angle so that they will be re-reflected from the ceiling to evenly light the room, and converge to prevent streaks on the ceiling.

(3) Reflectors of *lasting* brilliancy
so that the illumination does not become dim with the passing of time on account of the reflecting surface deteriorating.

(4) *Scientific* installation to produce known results
The reflectors must be the proper number of inches below the ceiling, the fixtures must be spaced correctly, the bowls must contain the right type of reflector (concentrating or distributing), etc.,

(5) *Natural* seeing conditions for the eye to work by
There must be no visible light sources. No sharp shadows. No direct or reflected glare. No blotchy illumination. No light rays striking the eye directly.

(6) *Low* maintenance cost
Washing of the reflectors must be made unnecessary to save time (Labor cost). Handling of the reflectors and lamps must be reduced to a minimum to save breakage. (Equipment cost).

(7) *Variety* and *Harmony* in fixture design
The interior bowl equipment, i.e., the powerful reflectors, the holders to keep them in the right position with relation to the lamp, etc., must be interchangeable and adjustable to special designed fixtures to harmonize with different interiors.

Before we applied science in perfecting X-RAY reflectors, and their appliances, which embody ALL these essentials, satisfactory Indirect Illumination was impossible. Time has not changed this condition!

These powerful X-RAY reflectors and interior bowl equipment are manufactured exclusively by us and used solely with the

EYE COMFORT SYSTEM
of Indirect Illumination

The most complete and best equipped Engineering Department in the country is always at your service.

National X-Ray Reflector Co.

CHICAGO
214 W. Jackson Blvd.

NEW YORK
505 Fifth Ave.

NEWTYPE BERGMANN LAMPS

(*Tungsten Filament*)

The Unbreakable Kind

Are Now Ready for Delivery

We guarantee delivery to you in good condition

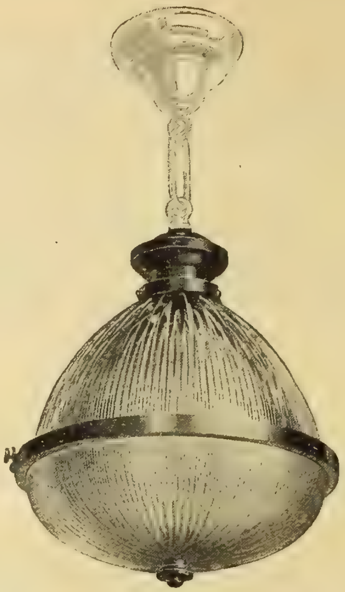
EXCLUSIVE CANADIAN DISTRIBUTORS

P. H. KLEIN CO., LIMITED

329 CRAIG STREET WEST
MONTREAL, P.Q.

LIVE AGENTS WANTED ALL OVER CANADA

No. 7610
Reflector Bowl
Data book page S 2.5



No. 8342
Realite
Data book pages S 2.7-2.9

No. 8310
Reflector Bowl
Data book page S 2.5

MADE IN CANADA

MADE IN CANADA

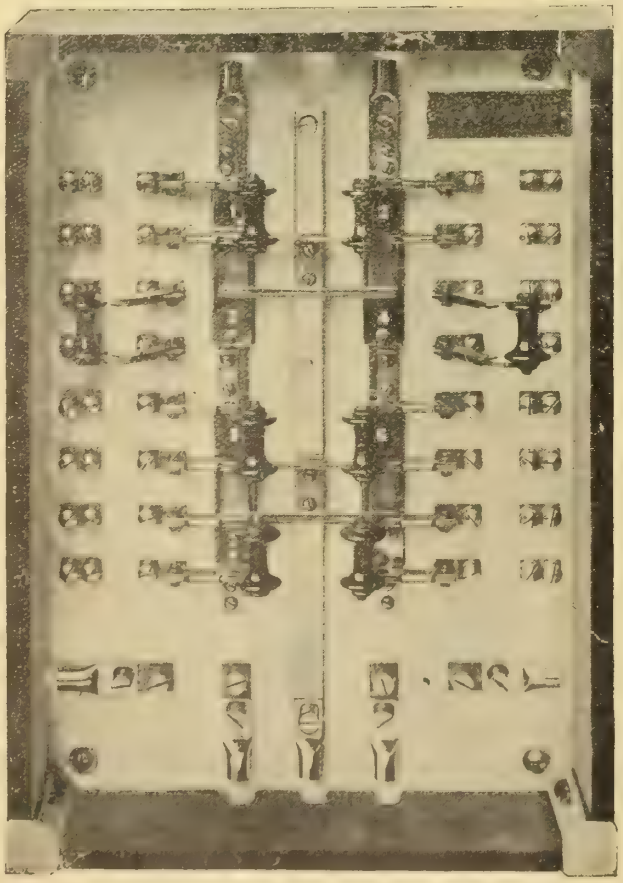
The most efficient enclosing lighting Unit ever made

Artistic and beautiful with wonderful results

New Holophane Units for Large Interiors

THE HOLOPHANE CO., Ltd., Toronto

Makers and Distributors of
HOLOPHANE GLASS and STEEL. IRIS - VELURIA - CALLA - PYRO - Cut and Etched.



KRANTZ
Switch Boards
and
Panel Boards

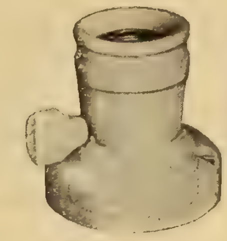
Are the make used in many of the largest institutions, office and government buildings in the United States and Canada.

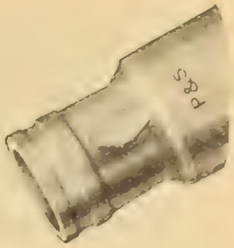
WHY?

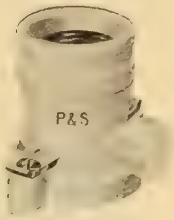
because they are the recognized leaders.

Send us your enquiries.

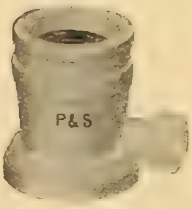
Canadian Agents
The C. H. L. Keeler Co. Limited
TORONTO, ONTARIO







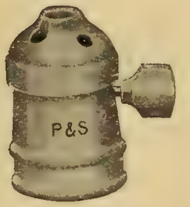
P & S
Handy Wiring Devices



The key action in all P & S porcelain key sockets and receptacles is snappy and positive.

The movement is double break single pole, a feature found only in P & S porcelain sockets.

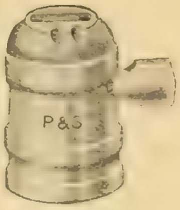
The key will not bind on the shell or body of the socket, thereby causing a portion of the key to chip off.



The design is symmetrical, and strength of all parts has been given unusual attention.

It is possible to use these sockets and receptacles with "Loxon" lamp guards without reaming the guard out.

All of these sockets and receptacles embody the interchangeable feature, which we have graphically illustrated in a little booklet known as our Form 750. We would like to send you a copy free, and will do so if you will ask for it.



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Central Electric & School Supply Company	Toronto
Mainer Electric Company	Winnipeg
Dawson & Company	Winnipeg
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Mechanics Supply Company, Limited	Quebec
St. John Railway Company	St. John N. B.
General Supplies Limited	Calgary, Alta.
John Starr, Son & Co., Limited	Halifax

PASS & SEYMOUR, INC.

Main Office and Works: SOLVAY, NEW YORK, U. S. A.

NEW YORK CITY, 178 Fulton Street SAN FRANCISCO, Rialto Building
CHICAGO, 700 West Jackson Blvd.
DENVER SALES AGENTS—B. K. Sweeney Electrical Co.

Pass & Seymour, Inc.
Solvay, N.Y.

Please send us booklet 750

Name.............................

Address.............................

City.............................

State.............................

Coupon No. 45

SUNBEAM LAMPS

are made from material and
knowing how

No Guess Work

Sunbeam MAZDA Tungsten Carbon
and Gem Lamps have often been

Imitated But Never Equalled

The label is the guarantee of

QUALITY

MADE IN CANADA BY

The Canadian Sunbeam Lamp Co.
Limited

Main Office and Factory:
Dufferin and Liberty Streets
Toronto

Northwestern Office and Warehouse:
173 McDermott Avenue
Winnipeg

Simplified Catenary Designs

Type C K Hanger

Type C K Hanger is made of only two parts—extruded ear and steel suspension strap.

Easily installed—clinch ear on trolley and snap loop over messenger.

No small parts to become lost—no threads to strip.

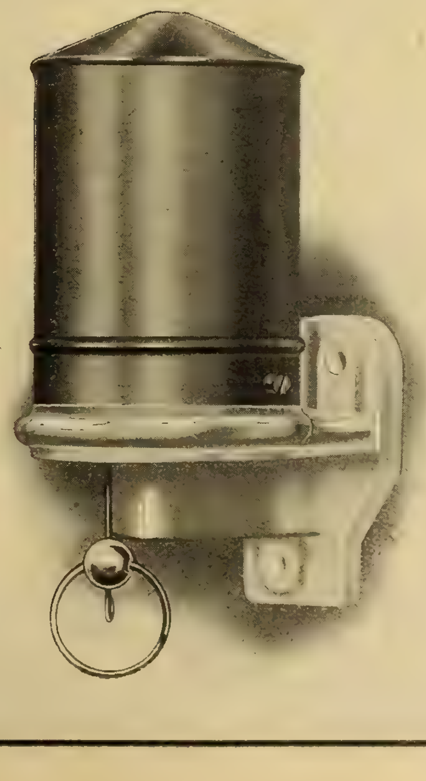
Affords maximum clearance for trolley wheel.

Above is but one example of how extreme simplicity has been introduced into all O-B catenary devices.

Full listing on pages 7 to 55 of Catalog No. 12

The OHIO BRASS CO., Mansfield, Ohio, U.S.A

FLAT RATE CONTROLLER



Satisfies Your Customer

Reduces Operating Costs

Eliminates Meter Disputes

Smallest, Lightest and Most Durable on the Market

Write for illustrated pamphlet and prices.

Made in All Capacities up to 5 Amperes

The Only Reliable Controller for Tungsten Lamps

The Gorla Current Limiter

3 Beaver Hall Square, MONTREAL

THE INSULATOR BOOK

VICTOR

To Thoroughly Rust-Proof

the metal parts entering into our product we use the sherardizing process carried on at our own plant at the Victor works.

This protection is applied to metal insulator pins, suspension insulator clamps and insulator parts, etc.

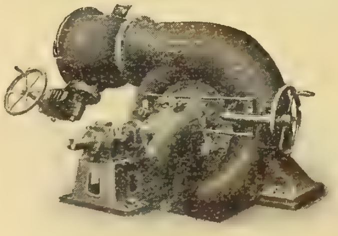
All metal, before sherardizing, is thoroughly sand blasted ensuring that the coating of zinc is applied to dry, clean, bright metal.

The rust-proofing of threads possible by this process is particularly valuable as applied to iron insulator pins and the bolts of clamps for "Victor" suspension insulators.

We can assure our customers that the quality of sherardizing done by us will not fall below the standard set and maintained for our other products.

THE LOCKE INSULATOR MFG. CO., Victor, N. Y.
OR
Engineering Equipment & Supply Company
410 St. James Street,
MONTREAL, QUE.

Water Power Plant



Type 30 Francis Turbine
1000 B.H.P. 120 Feet Fall

As supplied to Ocean Falls Pulp and Paper Co., Dryden Timber and Power Co. Expert advice at your immediate disposal for estimating purposes, etc.

James Gordon & Company
81 and 83 Knightrider Street, LONDON, ENGLAND.

Sole Canadian Agents
Chapman & Walker, Ltd.
69 Victoria Street, TORONTO

Longer Life at Lower Cost

For Satisfying Results in Underground Subway and Power House Construction specify American Bitumized Fiber Conduit. Strongest and most durable conduit made.

Electrolysis proof—water-proof—gas proof

Write for Booklet and General Information

American Conduit Co.
140 Nassau St., New York - East Chicago, Indiana

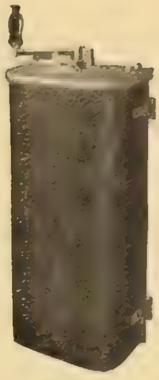
CUTLER-HAMMER

A.C. Starter, Drum Type
Bulletin 9135

A. C. Starter for Slip Ring Motors of Moderate Capacities
Bulletin 9135

6-in Speed Regulator for motors 1/20-1/6 H.P.
Bulletin 8520

D. C. Motor Starter
Bulletin 2110


Crane Controller ask for
Bulletin 5300

For the Unusual as Well as the Usual Requirements

Because of the thorough working out of each step in the development of the most extensive line of motor controllers on the market, our engineers know what changes or additions are needed to meet the out-of-the-ordinary requirements.

An important part of our business is providing for the unusual as well as the usual cases of motor control. Our specialized engineering force can take care of your motor control problems, no matter how different or difficult they are.

CUTLER-HAMMER MOTOR CONTROLLERS

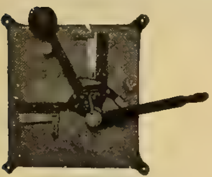
The Standard for Twenty Years

are used in a large majority of the motor installations in the country. They include the little regulators and starters used with the motors driving sewing machines, jewelers' buffers, etc., as well as starters for motors of every type and size—including the largest—and pump controllers, printing press and machine tool controllers, steel mill controllers, besides innumerable styles of automatic starters and controllers.

Because of the extensiveness of our line a standard controller will often accomplish what you may think will require special apparatus. If you have an unusual case, give us the particulars. Bulletins on any class of motor control apparatus will be sent you as soon as you ask us to.

Dust Proof D. C. Motor Starter
Bulletin 2190

Speed Regulator for Fans, Pumps, etc.
Bulletin 3110


Float Switch for use with Pumping Equipments and Self-Starters
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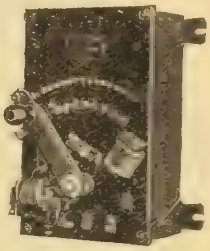
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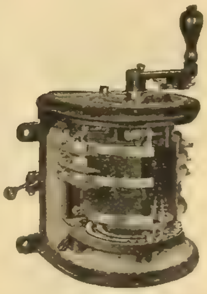
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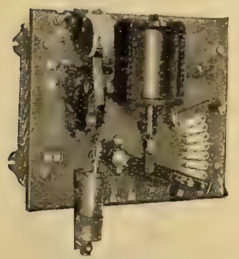
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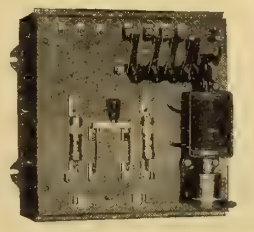
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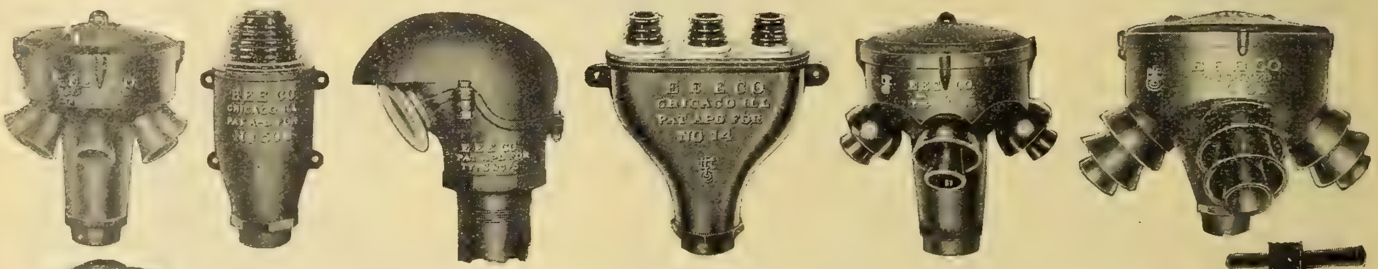

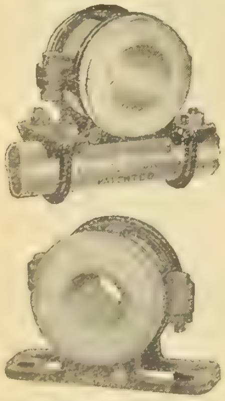

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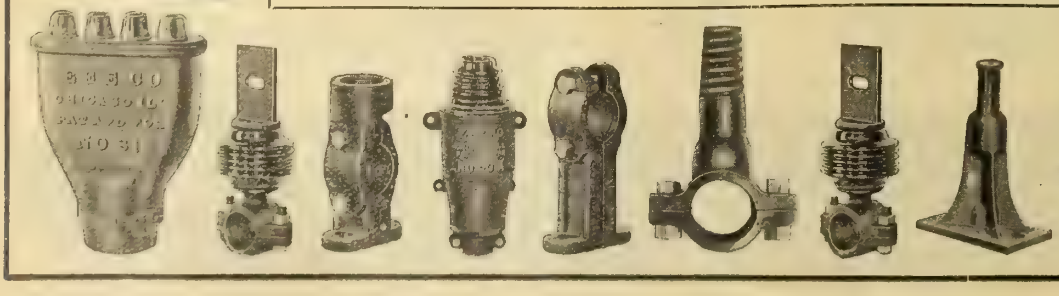

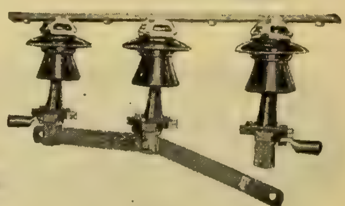

Electrical News
Generation, Transmission and Application of Electricity

PUBLISHED SEMI-MONTHLY BY
HUGH C. MACLEAN, LIMITED,
HUGH C. MacLEAN, Winnipeg, President.
THOMAS S. YOUNG, General Manager.

HEAD OFFICE - - 220 King Street West, TORONTO
Telephone Main 2362

MONTREAL - Telephone Main 2299 - 119 Board of Trade
WINNIPEG - Telephone Garry 856 - 404 Travellers' Bldg.
VANCOUVER - Tel. Seymour 2013 - Hutchison Block
NEW YORK - Tel. 3108 Beekman - 931 Tribune Building
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Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Vol. 22 **Toronto, January 1, 1913** **No. 1**

Auxiliary Plants

The present-day tendency in the larger hydro-electric generating plants in Canada is decidedly in favor of some form of auxiliary equipment. The present issue of the Electrical News contains a detailed description of the new steam turbine generating station just completed by the Winnipeg Electric Railway Company. Recent issues have described similar stations in Vancouver and Victoria erected by the B. C. E. R. Co. At the present time the Toronto Railway Company and the Toronto Electric Light Company are installing auxiliaries in the form of both steam turbo-generators and very large storage batteries. The Electric Power Company is just completing the installation of a Diesel oil stand-by in Oshawa, in addition to several steam plants already available at different points along their distributing system. The Ottawa Light, Heat & Power Company and the Ottawa Street Railway Company are also at present increasing their auxiliary equipment, and many other companies are following the same policy in a somewhat smaller way. It is noticeable, too, that these companies are all, or nearly all, possessed of what may almost be considered as unlimited water powers operating under very favorable conditions as to development and transmission.

The last few years have shown large improvements in the efficiency of prime movers in general and this is probably most marked in respect to the steam turbine, which is taking the place, to a considerable extent, of the reciprocating steam engine. Improvements in steam auxiliary equipment such as the automatic methods of handling coal and ashes have also added much to the over-all efficiency of these plants. As a consequence, the modern steam plant is capable of showing often as good results as the hydro-electric plant and this, coupled with the well-recognized advantages of having a second source of power in case of emergency, or to carry the peak load, has finally decided the larger companies in favor of such installations. No doubt with further improvements the practice will become more general and the day is apparently not far distant when the lack of near-by water falls will not be considered an insuperable obstacle in the way of cheap rates.

And with this improved steam equipment another phase of the power supply question is brought prominently to the front. At many points in Canada there are vast deposits of a fair quality of coal which, however, in the past, has been considered of too low a percentage in carbon content to justify, under the existing freight rates, its transportation over any considerable distance. Conditions even now point to a solution of the power supply to many cities, in our prairie provinces especially, in the installation of steam generating equipment at the source of supply, which, supplemented by high tension transmission lines, may easily become as efficient and as dependable and almost as inexhaustible a source of energy supply as our present hydro-electric systems.

Care of Storage Batteries

The winter care of storage batteries is the subject of a timely and helpful article by Mr. A. E. Wilkes in our present issue. It is not possible to calculate to what extent the more general use of storage batteries has been retarded by a lack of knowledge as to their proper care, far more than any other piece of electrical apparatus, possibly, the storage battery is susceptible to ill-treatment. On the other hand, careful and intelligent attention to a storage battery's needs will result in greatly increased efficiency and a much longer life, and incidentally will assist in readjusting the public's somewhat unfavorable opinion of storage batteries in general. The storage battery in its present state of development is a very useful equipment and is surrounded by great possibilities. With the gradual improvements that are pretty sure to develop, and with a little more technical knowledge on the part of the operator which will result in a more sympathetic attention to the needs of his batteries, the storage cell may be expected to meet with a much wider and more general application in the near future. The action of two Toronto companies in installing large storage battery plants for stand-by purposes indicates the trend of expert opinion regarding this type of equipment.

Toronto is Business-Like

Toronto, during the month of December has opened for service some two miles of municipal electric railway line. It would probably not be claimed by anyone that this street railway work was, in the earlier stages, carried forward with any marked enthusiasm, but it must have been a pleasure to every citizen of Toronto to watch the business-like progress of the last few weeks, during which time the service wires have been laid, the motor-generators installed, the cars purchased and delivered, not forgetting the snow-sweeper, and everything has been set running smoothly. It does not matter greatly that this line will not, temporarily, pay expenses, though, if the same "free hand" is given to the same man who has already done such effective work, it is quite likely the deficit will not be long-lived. This example plainly points a good course for any municipality to follow,—employ men with good business instincts, pay them whatever is necessary to keep them, give them all the authority necessary to get results and keep the council occupied, for the time being, with something else.

New Hydro Rates

Further reductions, based on actual consumption, have been made in the price to be charged the different municipalities under their contract with the Hydro-electric Power Commission of Ontario. The following table gives the present and the new rate which, with the exception of some half dozen cases, represent a substantial reduction from the rates published in our November issue, and which at that time were based on estimates which have since been more than fulfilled:

	Present Rates	New Rates
Baden	$37.00	$37.00
Beachville	33.89	31.00
Berlin	25.00	22.50
Brampton	29.00	25.00
Dundas	17.33	16.00
Galt	25.00	22.00
Guelph	25.00	22.00
Hamilton	17.90	16.00
Hespeler	26.00	23.00
Ingersoll	28.00	25.50
London	28.00	24.00
Mimico	30.74	30.00
Mitchell	38.00	37.00
New Hamburg	32.00	32.00
Norwich	30.00	32.00
Port Credit	36.79	31.00
Preston	25.00	21.50
Seaforth	41.00	40.00
St. Marys	38.00	29.50
Stratford	32.00	30.00
St. Thomas	32.00	29.00
Tillsonburg	32.00	32.00
Toronto	18.10	15.00
Waterdown	37.50	26.00
Waterloo	26.00	23.50
Weston	30.00	30.00
Woodstock	26.00	23.00

An Act Respecting Radio-telegraphy

As the result, in part, no doubt, of the very large number of amateur and semi-commercial wireless telegraph outfits that are being installed now-a-days, and which interfere more or less with the legitimate business of the Dominion or of the government, an Act to regulate these has been introduced in the House of Commons by Mr. Hazen. By this Act no person shall establish any radio-telegraph (this term including any wireless system of conveying electric signals or messages including radio-telephones) station or install or work any radio-telegraph apparatus in any place in Canada or on board any ship registered in Canada except under and in accordance with a license granted by the Minister.

The Act further states that after July 1, 1913, no passenger steamer, whether registered in Canada or not, carrying fifty or more persons, including passengers and crew, shall leave or attempt to leave any Canadian ports unless such steamer is equipped with an efficient radio-telegraph apparatus in good working order capable of transmitting and receiving messages over a distance of at least 100 miles by night or day, and in charge of a person fully qualified to take charge of and operate such apparatus.

Inland Revenues Report

The report of the Inland Revenues Department for the year ending March 31, 1912, with reference to weights and measures, gas and electricity, is just to hand. The report shows that the total expenditure in connection with electric light inspection for the year, amounted to $35,005.20, as against a revenue of $66,561.20. The number of electric meters presented for verification during the year, totals 93,295. It is interesting to note that of this number 35,494 registered correct, 38,526 a little fast, 19,084 a little slow, both of these latter, however, falling within the error tolerated by law. The total number of rejected meters, therefore, only amounted to 178, as compared with 93,117 verified.

The number of electric light companies and corporations registered under the Electric Light Inspection Act during the year ending March 31, 1912, totals 426, and the number of 16 carbon candle power equivalents supplied amounts to 4,315,807. To this total amount the larger cities contribute approximately as follows:—Montreal, 625,000; Toronto, 520,000; Vancouver, 400,000; Winnipeg, 280,000; Ottawa, 250,000; Quebec, 140,000; Hamilton, 137,000; Victoria, 110,000; Halifax, 65,000; Calgary, 60,000; London, 55,000; St. John, 50,000.

Under the heading of Electrical Energy Generated for Export and for Consumption in Canada, nine companies are now included, four of which appear for the first time. These are the Electric Distributing Company, of Windsor, Ont.; The Sherbrooke Railway and Power Company; The B. C. E. R. Company, and the Western Canada Power Company. Of these the first two have not yet begun to export, but have been granted a license to do so. The other two have been exporting for a part of the year only. The accompanying table gives the exact figures under this latter head:

Statement showing total amount of Electrical Energy expressed in Kilowatt Hours and Horse Power Years, Generated for Export and for Consumption in Canada, by the Hydro-Electric Companies during the Fiscal year ended March 31, 1912.

Name of Contractor.	Place of Business.	Units Generated for Export.		Units Generated for Consumption in Canada.		Total Output of Generating Station or other Sources.	
		Kilowatt Hours.	H. P. Years.	Kilowatt Hours.	H. P. Years.	Kilowatt Hours.	H. P. Years.
Ontario & Minnesota Power Co	Fort Frances, Ont.	18,920,173	2,895.22	1,407,804	215.42	20,327,977	3,110.64
Canadian Niagara Power Co.	Niagara Falls, Ont.	295,125,050	45,160.95	11,903,550	1,821.52	307,028,600	46,982.47
Electrical Development Co	" " "	8,274,600	1,266.25	135,473,774	20,730.62	143,748,374	21,996.87
Ontario Power Co.	" " "	213,658,241	32,694.65	199,658,759	30,552.47	413,317,000	63,247.12
†Electric Distributing Co.	Windsor, Ont.	....	....	....	....	....	....
*Sherbrooke Ry. & Power Co	Sherbrooke, Que	....	....	....	....	....	....
Maine & New Brunswick Electric Power Co.	Aroostook Falls, N.B.	2,002,557	306.44	55,649	8.51	2,058,206	314.95
British Columbia Electric Ry. Co.	Vancouver, B.C.	⊙64,820	⊙9.92	80,152,596	12,265.20	80,217,416	12,275.12
‡Western Canada Power Co.	" "	30,960	4.74	1,154,547	176.67	1,185,507	181.41
	Totals.	536,076,401	82,338.17	429,806,679	65,770.41	967,883,080	148,108.58

† No plant installed yet, though export license was issued in June, 1911.

* License issued in December, 1911, but nothing was exported during the above fiscal year.

⊙ For last four months only of fiscal year, as export did not start till December, 1911.

‡ For last three months only of fiscal year, as export did not start till January, 1912.

Trent River, Dam No. 5

The Electric Power Company are pushing actively the work of construction at Dam No. 5 on the Trent River, below Frankford, with the intention of completing the installation before the winter sets in. There have been serious difficulties to contend with owing to the exceptionally high water during the summer, but the work has now reached a stage at which the construction can be carried along without fear of further delay. The installation of the equipment is at present under way. The electrical equipment consists of four 812½ kw., 7000 volt, 3-phase, 60 cycle, vertical-shaft generators, operating at 112½ r.p.m.; one 75 kw., 225 r.p.m., vertical-shaft compound wound, d.c. generator, direct connected to vertical turbine with ball thrust bearing for carrying the total weight; and one 75 kw. motor generator set. The generators and exciters were manufactured by the General Electric Company of Sweden, and supplied by Messrs. Kilmer, Pullen & Burnham, Limited, Toronto. The switchboard is being built by the Monarch Electric Company, who also supply the necessary cables and connections. The hydraulic equipment is supplied by the Canadian Boving Company, Toronto, and consists of four vertical double-runner turbines, 1500 B.h.p., 112½ r.p.m. This plant is a duplicate of that already in operation at Dam No. 2. It is expected that water will be turned into the new installation before Christmas.

Renfrew Operating

The Corporation of Renfrew have recently put their new hydro-electric plant into operation and the tests made have demonstrated the fact that the design and lay-out of the whole equipment are strictly up to the best standards. The buildings are tastefully designed and the hydraulic lay-out guarantees operation under the most difficult conditions. The electrical equipment consists of two 250 kilowatt, 400 r.p.m., 2300 volt, 2-phase, 60 cycle, a.c. generators, one unit being direct connected at one end to a water wheel and at the other end to a Bellis & Morcom high speed engine. The second unit is driven by a water wheel alone and this machine is equipped with direct connected exciter.

The hydraulic apparatus was supplied and installed by the S. Morgan Smith Company, of York, Pa., and the generators and exciters by Messrs. Kilmer, Pullen & Burnham, Toronto, sole dealers for the General Electric Company of Sweden. The switchboard was supplied and installed by the Canadian Westinghouse Company. Mr. J. B. McRae, of Ottawa, acted as consulting engineer on the undertaking, and Mr. J. R. Stewart, town engineer of Renfrew, supervised the work of construction for the corporation.

Hamilton is Prosperous

The Commissioner of Industries of Hamilton, Mr. H. M. Marsh, has prepared a very interesting report on the industrial development of that city during 1912 and the outlook for 1913. The report states that on every hand there are indications of great prosperity and that the development and expansion during 1912 has been so far in advance of all previous years that it may be called phenomenal. The report goes on to show the number of industries secured by Hamilton during the past year. These have been attracted largely by the electrical facilities of that place, Hamilton now being served both by the Hydro-electric Power Commission of Ontario and by the Dominion Power and Transmission Co. The power requirements of the city under their agreement with the Commission have increased so rapidly that the rate is even smaller than was anticipated and there are indications of further reductions.

Activity in the Maritime Provinces

The Nova Scotia Knitting Co., Eureka, N.S., are installing an electric lighting system in their mills and in addition will light the town of Eureka.

The electors of Dalhousie, N.B., have voted thirty thousand dollars for the installation of an electric light plant. Willis Chipman, C.E., of Toronto, has been engaged by the town to prepare plans and specifications.

The Eastern Hat & Cap Co. of Truro, N.S., are installing an electric light and power system in their new factory at Truro. The system will be 220 volt, direct current, the lighting being done with 55 volt tungsten lamps placed four in series.

The town council of Trenton, N.S., recently decided to illuminate the streets of that town and have entered into a contract with the Pictou County Electric Co. for the installation of one hundred sixty-watt series tungsten lamps. This town is having quite a boom at present on account of the Eastern Car Co. erecting their street car building plant there.

The Canadian Car & Foundry Co., Amherst, are making extensive additions to their car building plant. These additions will require some five hundred horse power in motors. The current to operate same will be purchased from the Canada Electric Co. The Canadian Car & Foundry Co. are also installing motor drives in the new addition to their malleable iron works.

G. R. Marshall, of Stemacke, N.S., has recently installed a lighting system in that town. The generator, a 50 kw., 3 phase, 2200 volt belted unit, is operated in his steam mill. In addition to lighting the town of Stemacke, Mr. Marshall has also bought out the Shubenacadie Electric Co. and is now operating the latter from Stemacke over a four mile single phase transmission line.

The Maritime Motor Car Co. of St. Johns, N.B., are erecting a plant at Cold Brook, N.B., for the manufacture of high grade automobiles. The buildings, two in number, each 250 ft. x 100 ft., will be equipped with electrically driven machinery. For the present current will be purchased from the St. John Ry. Co. The lighting of buildings will be done by flame arc lamps and 55 volt tungstens. The company plan on installing their own power plant at a later date.

The Acadia Sugar Refinery Co. whose plant at Woodside, Dartmouth, was destroyed by fire, are now rebuilding on a very extensive scale. This plant will be operated throughout with individual electric drive. The specifications for power plant are not out yet. James Buchanen of Liverpool, England, are the consulting engineers. An addition is being made to the boiler plant and a smoke stack 260 ft. high is being erected. This stack has a diameter of 21 ft. at the base and when completed will be one of the largest in Canada.

The Nova Scotia Carriage and Motor Car Co. have about completed a four storey brick factory at Amherst, N. S. The main building is 300 ft. x 100 ft. and will be used for the manufacture of motor cars and carriages on an extensive scale. The office and power house are situated in separate buildings. The factory will be operated throughout with 3 phase, 60 cycle, 220 v. motors ranging in size from one to twenty horse power. The power house equipment consists of one 3 phase, 60 cycle, 220 volt, 187 kv.a. 167 r.p.m. C. G. E. generator direct connected to a Robb Corliss engine. The building will be wired in conduit, the lighting being done with 55 volt tungsten lamps.

The Makers of Electrical Canada—15

R. F. HAYWARD—HYDRO-ELECTRIC ENGINEER

The subject of our sketch this month, Mr. R. F. Hayward, general manager of the Western Canada Power Company, Limited, Vancouver, B.C., was born at Harrow, England, in the year 1865, and received his early education at Harrow School, afterwards attending classes at the University College, Engineering School, London. In 1885 he became a pupil of Crompton & Company, Chelmsford, Eng., and went through the mechanical shops of the firm as an apprentice. Later, in 1889, Mr. Hayward became works manager for the company, and held this position until 1894, when he joined the Salt Lake and Ogden Gas & Electric Light Company at Salt Lake City, Utah, acting as general manager for this concern until 1897. In that year he was appointed chief engineer of the Utah Light & Railway Company.

During his stay in Utah, Mr. Hayward was engaged in the development of long distance transmission of power in that state, including the construction and operation of several hydro-electric plants and about 200 miles of transmission line. Leaving the last named company in 1905, he sought a new field of activity in Mexico, and was general manager of the Mexican Light & Power Company in Mexico City from 1905 till 1909. During this period he superintended the construction and operation of a 40,000 h.p. hydro-electric power plant, including 170 miles of high tension transmission line for the same company. When the Mexican Light & Power Co. was taken over during 1909 by the Mexico Tramways Co., Mr. Hayward resigned his connection with the former company and returned to Canada to associate himself with the directorate of the Western Canada Power Company. He later went to British Columbia as general manager of this company, towards the end of 1909, since which date he has designed and constructed the Stave River Falls plant near Ruskin, B.C., some thirty-five miles east of Vancouver. This plant is regarded as one of the finest examples of efficient engineering practice on the continent to-day. It has a present capacity of 25,000 h.p. in two units, but plans are already under way for further additions. The total final development at this point will be approximately 100,000 h.p.

Mr. R. F. Hayward

Mr. Hayward is also intimately associated with the construction plans and management of the Prince Rupert Hydro-electric Power Company, who control water powers in the vicinity of Prince Rupert, B.C., aggregating some 30,000 h.p.

Mr. Hayward is a member of the American Society of Civil Engineers and of the American Institute of Electrical Engineers.

The Cost of Service

Some interesting information was recently brought forward by the New York Edison Co., who appeared before the Public Service Commission for the First New York District as the result of a petition that had been filed to the effect that the rates of the New York Edison Co. discriminated unduly in favor of large users of energy and that the rates charged to smeller users were excessive and out of proportion to the cost of production. In the course of an examination of Mr. Geo. W. Lieb, Jr., 3rd vice-president of the company, it was stated that the average 10-c. or retail customer, the customer who never uses an excess of 250 kw. hours monthly and who, as a class represents nearly 80 per cent. of all the commercial customers on the company's books, is actually being served below the average cost for rendering this particular service and therefore at a direct loss to the company.

This company had placed certain new reduced rates in effect on July 1st, 1911, as a result of which there was a total decrease in revenue from all sources in the twelve months ended July 31, 1912, of approximately $1,250,000, of which $850,000 or approximately 70 per cent. was attributable to the small lighting customer. Mr. Lieb stated that the company's experience showed that there was no appreciable addition in new business as a result of the new rates which confirmed his past experience as to the futility of relying upon any considerable increase in new business and revenue, over the usual natural growth, as an offset to the direct loss of revenue attendant upon the introduction of lower rates. Under the new schedule of rates the average return is 6.87c. per kw. h., while the average cost of serving all the customers of the company is given as 3.68c, per kw. h. exclusive of fixed charges, dividends, etc.

In justification of the general policy of giving a lower rate to the larger customers the witness stated that in his company the service connection for the small consumer represents an investment of over $65 per customer or more than $542 per kw.h., which decreased in proportion as the size of the installation increased.

The Vibrating Rectifier

A new device has recently been brought out for mechanically changing alternating current of standard voltage to low voltage direct current. The photograph and diagram shown herewith will represent the principle on which the rectifier works. It is essentially an electrically operated vibrating switch which reverses the connection of the alternating current line to the battery in synchronism with the alternations of the current, this reversing action being accomplished at the moment when the current flow is zero. The result is the delivery to the battery of an intermittent pulsating current always in the same direction which charges the battery in the same way as would a constant voltage direct current.

The movement of the vibrating switch is controlled by two alternating current magnets, M M Fig. 1. A small two-winding transformer reduces the a.c. line voltage to the proper value for charging the battery. In this figure A B represents the primary and C D E the secondary side of the transformer. Across one half of the low voltage winding the two a.c. magnets are connected as shown in Fig. 1 between C and D. These magnets are so wound that the lower ends have always the same polarity, that is, during one half wave of the alternating current the lower ends of each of the magnets M M will be a north pole and during the other half of the wave each of the lower ends will be a south pole. A permanent oscillating magnet F H hinged at G is placed relatively to the a.c. magnets as shown. Platinum contact points close the circuit alternately at F and H as the magnet oscillates. In practice F H is magnetized directly from the battery which thus maintains the poles permanently the same.

The operation of the rectifier is briefly as follows: If E is positive to D the current flows from E to D to P to N to G to H to E, the winding of M being such as to draw the point F away from its platinum contact and depress the end H thus closing the circuit at H. When C becomes positive to D the current flows from C to D to P to N to G to F to C, the change in current direction in the magnets M M having reversed their poles so that H is now drawn up, and F is depressed making contact at that point.

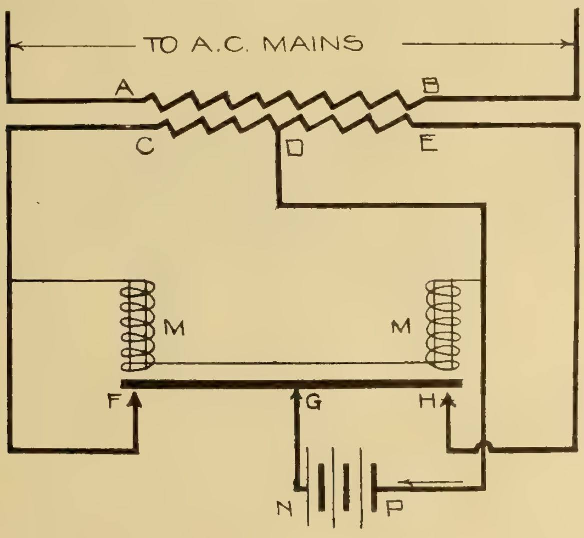


Fig. 1

In actual practice, regulating resistances are installed between E and H, C and F, M and M, and condensers properly placed absorb any induction effects which follow the breaking of the current at F and H.

The rectifier as yet, has not been developed for universal use and operates best on 60 cycle current at anywhere from 100 to 120 volts. Under these conditions it gives a sufficient voltage to charge three cells at a rate of from six to eight amperes. It will thus be seen that the device is particularly valuable in charging small batteries and it is specially designed for the use of automobile owners who use a small battery for lighting or ignition purposes. The vibrater occupies very little space and can be hung on the wall or carried around in the tool box of an automobile. It costs only about 1c. per hour to operate on the basis of 10c. per kw.h. for power. Another useful factor in the consideration of this rectifier is that it makes no difference, in practice, how the battery is connected up, inasmuch as the direct current magnet being energized from the batteries, will change its polarity to suit the changed conditions. Fig. 2 is a photograph of the vibrater with cover removed. The function of the different parts can be traced by comparison with the line sketch above.

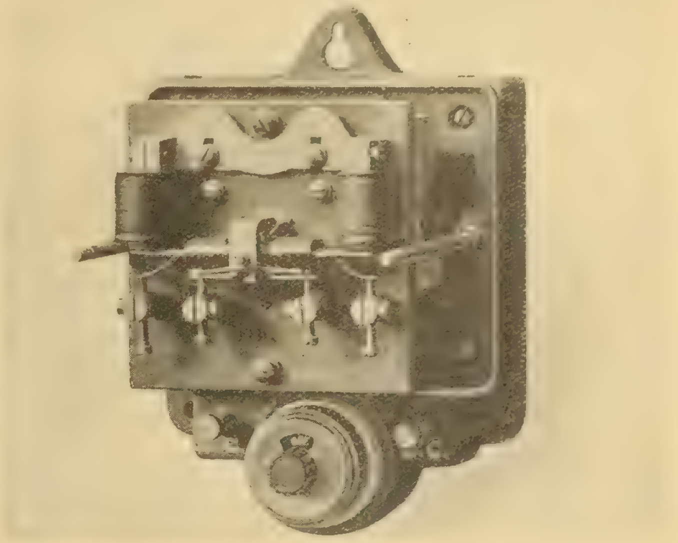


Fig. 2

Winter Care of Storage Batteries

By Mr. A. E. Wilkes

The use of storage batteries in connection with gas engines is becoming so common for ignition as well as lighting and power that information in regard to their proper treatment should be of interest to a very large percentage of gas engine users.

At this season of the year, the question which naturally arises is as to how they are affected by cold; what special precautions should be taken; or, when only used in the summer, how are they to be taken out of commission.

With proper precautions there need be no fear of a storage battery freezing and causing breakage, even at very low temperature. Electrolyte of a specific gravity of 1.210 freezes or congeals at about 25 degrees below zero. This strength of electrolyte is used in most stationary batteries. Portable cells, whether of the ignition or vehicle type, use much stronger electrolyte, and freeze at still lower temperatures. Further, where electrolyte freezes, it does not freeze solid but forms a slushy mass, which is not likely to cause breakage.

Where water is simply poured into the cells without any mixing, it is apt to collect largely on top of the electrolyte, so this water will naturally freeze solid, and may cause breakage if the temperature drops below the freezing point. In order to avoid so-called stratification, water should preferably be added to the cells when they are just beginning to gas on charge, and the charge continued until the cells have gassed freely for an hour or so. The gassing will then thoroughly mix the electrolyte and water and eliminate all danger of freezing. If the plant is out of commission, or it is not practicable to charge during the addition of water, the electrolyte and water should be thoroughly stirred, using some kind of non-metallic paddle or stick. As it is quite difficult to mix electrolyte and water in this manner, a great deal of stirring is required, and an upward motion should be given to the paddle in order to lift up the strong electrolyte and mix it with the water. Where practicable it is decidedly preferable to charge the battery during the addition of water rather than to depend upon mechanical stirring.

As will be seen, any danger from breakage due to cold can be quite easily eliminated, but there is another effect of cold upon storage batteries which is not so easily handled, viz., the reduction in the available capacity. This reduction is not permanent, as the capacity is restored without any injury to the plates when the temperature is brought back to normal, but especially in the case of lighting plants, greater capacity is often needed in winter than in summer, and unless plenty of capacity has been provided, this matter may sometimes prove serious.

The first remedy which suggests itself is heating, and this will, of course, take care of the trouble and is the best solution where the conditions are such that heating is practicable. There are, however, many cases, especially small isolated plants, where it would be difficult as well as expensive to provide heating. Fortunately most of these plants are installed with sufficient capacity to carry the load for several days or a week, and in such cases all that is necessary is to charge more frequently in order to avoid reaching the discharge limits. In cases where there is only sufficient capacity for one day at normal temperatures, it will be necessary either to provide heating or increase the capacity. In small plants it will generally be found more economical to increase the capacity of the storage battery, as the cost of this will not be great as compared with the expense and trouble of heating and the extra capacity means longer life for the plant.

The reduction in capacity from low temperatures varies somewhat with the type of battery and the discharge rate, but in the types of service we are considering it may be figured at approximately one-half per cent. per degree Fahrenheit below normal. On this basis for example, at a temperature of thirty degrees Fahrenheit, the reduction would be some twenty per cent., or the available capacity would be reduced about one-fifth.

Cold increases the charging voltage of a storage battery, so that where cells are charged, through fixed resistances, the charging rate may be reduced, and thus a longer charging time be required in order to restore the capacity to the cells. Where this reduction becomes appreciable it can usually be overcome by increasing the generator voltage. Do not be surprised, therefore, if the voltage of the cells comes up very much higher in winter than in summer for the same condition of charge.

The specific gravity readings of the electrolyte behave somewhat like the voltage. For a given state of charge, the specific gravity readings will be higher when the electrolyte is cold than when warm. Thus it will be found that with proper charging the readings reached at the end of charge will gradually increase as the temperature falls in winter and decrease in summer, this phenomenon being perfectly normal.

Finally, there is a very large percentage of batteries, isolated plants, vehicles, cells and ignition batteries which are only used during the summer for three or four months, and remain idle during the rest of the year. In such cases the best method is to give the battery a good gassing charge about once a month, adding sufficient water to replace the evaporation and keep the plates covered. If this is not convenient and the period of idleness is not over nine months, the battery should be given a thorough charge, continuing until absolutely sure that the voltage and sp. gr. readings will not rise any higher, and then the battery can be disconnected at its terminals and allowed to stand without any further charging. During the charge and when the cells are gassing, as much water should be added to them as they will take without overflowing. Should the evaporation during the idle period, which, as already stated, must not exceed nine months, be so great that the level of the electrolyte falls below the tops of the plates, sufficient water must be added to keep them covered; and in this case, unless the battery can be charged it will be necessary to stir the electrolyte and water mechanically in order to prevent freezing. After such a stand, the battery will require a thorough overcharge before it is ready for service.

In the comparatively rare cases where it is desired to take plants out of commission for more than nine months, and charging cannot be provided for, the only safe plan is to take the cells out of commission by allowing the plates to dry. In the case of glass jar batteries, the cells are given a thorough charge, and the electrolyte is drawn off and stored in suitable vessels, preferably carboys. The cells are then filled with pure water and allowed to stand for some fifteen hours, when the water is drawn off and the plates are allowed to dry. Sometimes the negative plates show a tendency to heating during the process of drying and in this case they should be sprinkled with water in order to keep them cool. After drying, the plates will stand indefinitely without any attention, but require a complete initial charge before they are again ready for service. When the cells are equipped with wooden separators these should be removed, before allowing the plates to dry, and thrown away.

In the case of portable cells, or those set up in rubber jars, it is necessary to remove the plates from the jars and separate them before drying. After drying, the negatives should be allowed to soak in electrolyte for three or four hours and again rinsed, when they are ready for final drying and storage.

It is hoped that the above suggestions will cover the average cases which battery users are likely to encounter, but it cannot be emphasized too strongly that where special conditions come up which are not understood, the only safe plan is to consult the manufacturer before going ahead. A battery requires comparatively little attention, but, on the other hand improper handling may cause serious damage.

Jovian Notes

Morgan P. Ellis, sales manager of the Benjamin Electric & Manufacturing Co., Ltd., has been appointed Statesman at Large of the Sons of Jove during the period of the new reigning Jupiter Frank Watt.

On Nov. 15th at a meeting of the Sons of Jove at the Engineers Club, presided over by Mr. Parker H. Kemble, Statesman for Ontario, an address was given by Mr. E. L. Cousins, engineer of the Toronto Harbor Commission.

The Jovians of Toronto are having weekly luncheons this winter, which are held every Friday at the Woodbine Hotel. These luncheons are well attended. Arrangements are being made to hold a Rejuvenation about the 20th of January, the exact date of which has not been settled at the time of going to press.

The Modern Steam Turbine

Up to the year 1895 the turbine idea had not been applied to machinery operated by steam. In that year Parsons' steam engine was first introduced and since that time with improvements and developments in construction, the application of steam turbines has been the means of revolutionizing steam engine operation the world over. Roughly speaking, there are two general classes of steam turbines, those employing the reaction principle and those employing the impulse principle.

In the reaction type of turbine approximately one-half of the expansion in any one stage takes place in the stationary blades imparting to the steam a velocity substantially equal to that of the moving blades so that it enters them without impact. The remainder of the expansion takes place within the moving blades, the spaces between which gradually grow smaller from the inlet to the exit side of the turbine, forming a ring of moving nozzles. The velocity imparted to the steam by reason of the expansion within the moving blades produces a reactive force on these blades which turns the rotor of the turbine. This effect is very similar to the rotation produced by water issuing from an ordinary hose nozzle.

In the impulse type of turbine the complete expansion for any one stage takes place in the stationary blades or nozzles and the steam is delivered to the moving blades with a velocity somewhat more than double that of the blades. The passages between the moving blades are of uniform or even slightly increasing cross section from inlet to outlet. The moving blades check and reverse the velocity of the steam current and the reluctance of the steam current to alter its direction and velocity gives rise to a force against the blades which sets the rotor in motion.

In later practice a combination of these two principles is utilized in such a way that the advantages of both are made use of. The first stage of the expansion in the reaction turbine is the least efficient part of this machine In the combination this is replaced by a single impulse element. The intermediate and low pressure sections are retained because in these the volume of the steam is sufficient to require reasonably long blades moving at considerable velocities, which experience shows to have a decided economic advantage over the impulse type at this stage. The use of the single impulse element also makes possible a shorter turbine and consequently a much stronger rotor.

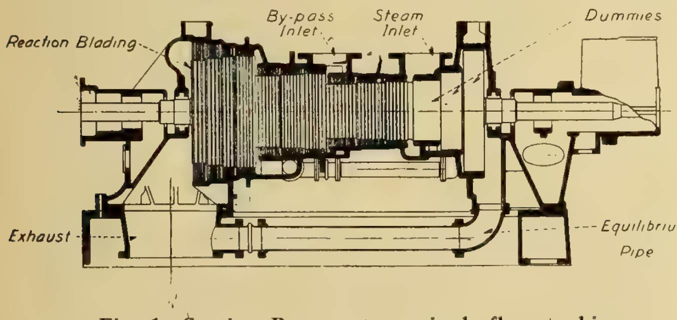


Fig. 1—Section Parsons type single-flow turbine

In the all-impulse type the rotor is built up by discs mounted on a shaft of small diameter so that the circumferential clearance between the shaft and the diaphrams separating the pressure chambers may be as small as possible, in which case the considerable pressure drops between adjacent stages will not cause too much leakage. In the reaction type the pressure drops between adjacent stages are very much smaller and the body of the rotor is often built up in the form of a hollow drum which is a stiffer construction than the shaft and disc design and therefore so much safer. Illustrations of the different general types of steam turbine follow with brief descriptive matter in each case.

The Single Flow Type

Figure 1 illustrates the original single-flow Parsons type. Steam is admitted as shown to an annular chamber in the casing. From this point it passes alternately through rings of fixed and moving blades of increasing lengths on the small diameter of the drum or rotor, expanding in volume as it passes through the successive rings. When the volume of the steam has increased to the extent that the blades on the smallest diameter of the drum and casing would have to be inconveniently long to provide outlet for it at a sufficiently low velocity, the diameters of the drum and casing are increased for the next stage of the expansion. When the blades in the second stage reach a certain length the diameter is again increased.

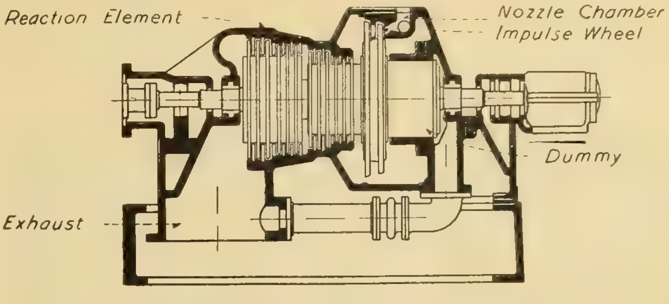


Fig. 2—Combination Impulse and Reaction type

The available area of the steam passage through the blades is an approximately constant percentage of the product of the mean circumference of the blade ring multiplied by the length of the blades. If the mean diameter of the blade ring in the second stage be increased to about 1.42, that is $\sqrt{2}$, times that of those in the first stage, the area through each blade ring per unit length of blade height will be 1.42 times that through the first stage of blade rings. Further, on account of the larger diameter the mean speed of the blades will also be 1.42 times that of the blades in the first stage and also on that account too the velocity of the steam through the blades in the second state would be 1.42 times that in the first stage. Now, if the area of the second blade ring per unit height of blade and the velocity of the steam through the blades are both 1.42 times as great as in the first stage and if the blade length remained the same in each case the quantity of steam that would pass through the second stage would be 1.42 x 1.42 or $\sqrt{2} \times \sqrt{2}$, i.e. 2, times as much as through the first stage. It follows, therefore, that to pass the same volume of steam per second through the blades in the second stage will only require these blades to be one-half as high as in the first stage.

As the steam expands in the second stage its volume increases until the blade heights again become excessive. The drum diameter is again increased therefore, and the blade heights of the enlarged diameter are reduced as before. Expansion again proceeds along this third stage through progressively increasing blade rings until the pressure of the steam falls to that of the atmosphere or the exhaust.

Impulse and Reaction Single-Flow Type

Fig. 2 illustrates a modification of the single flow design in which the smallest part of the drum of the reaction blading is replaced by a single impulse wheel. As already stated, this part of the reaction turbine is the least efficient of the three stages. The steam is admitted to the nozzle block, is expanded in the nozzle, and then discharged against a portion of the periphery of the impulse wheel.

It will be seen from the drawing that the intermediate and low pressure stages are identical with the corresponding stages in the design shown in Fig. 1. It is not claimed that the substitution of the impulse element for the high pressure section of the reaction blading has any influence one way or the other on the efficiency. The design is attractive, however, in that it shortens the machine and gives a stiffer rotor.

The Double Flow Turbine

Fig. 3 shows a section of a double-flow type turbine. The capacity of a single-flow turbine is limited by the rotation speed. The economic velocity at which the steam may pass through the blades of the turbine depends on the velocity of the moving blades. The capacity of the turbine depends on the weight of the steam passed per unit of time, which in turn depends on the mean velocity and the height of the blades. For a given rotating speed the mean diameter of the blade ring is limited in practice by the allowable stresses due to centrifugal force. As a result there is a practical limit to the height of the blades.

If, therefore, the rotative speed is made only half as great, the maximum diameter of the rotor may be doubled and therefore the capacity of the turbine will be doubled without increasing the height of the blades. Just as with the single crank reciprocating engine so with the single-flow steam turbine there is a practical limiting economical capacity for any given speed. When this limit was reached with the single crank reciprocating engine a unit with double the power was produced by coupling two single crank engines to one shaft. In exactly the same way the power of the steam turbine was doubled by making a double-flow turbine, which is in effect, as will be seen from the figure, two single-flow turbines built up in a single rotor, in a single casing with one common inlet but with two exhausts. Steam enters the nozzle chamber as shown in the figure, acts first on the impulse element and then divides into two parts, one half going through the reaction blading at the left of the impulse wheel, the other half through the impulse blading at the right.

A modification of the double-flow turbine is shown in Fig. 4, in which both the high pressure reaction unit and the intermediate section of reaction blading is single-flow, the low pressure section only being double-flow. This would be analagous to a triple compound reciprocating engine with one high pressure, one intermediate pressure and two low pressure cylinders—a not uncommon design. Such turbines are useful for capacities greater than is desirable for a single-flow turbine but which are still below the maximum possibilities of a double-flow turbine of the same speed. In such machines the best efficiency is secured by making the intermediate blading in a single section large enough to pass the entire quantity of steam.

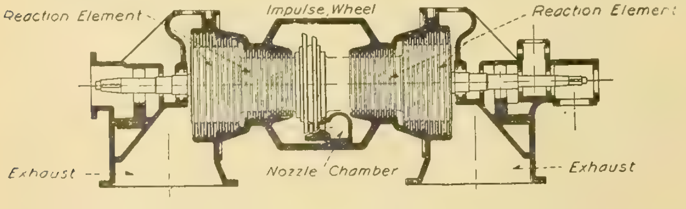


Fig. 3—Section of double-flow turbine

Special Turbines

The turbine principle, in addition to the above applications, is sufficiently flexible as to be capable of other special adaptations. What are known as "low pressure" turbines use exhaust steam from non-condensing engines and are valuable as supplementing exhausting plants for increasing the capacity with a minimum outlay for new equipment. Theoretically the capacity can be more than doubled by the use of the low pressure steam from a non-condensing engine and even in practice results well up to this point have been secured. Another type known as "bleeder" turbines are designed for use in plants which are required to furnish not only power but also considerable and varying quantities of low pressure steam for heating purposes. In these turbines a part of the steam which has done work in the high pressure stages may be diverted to the heating system and a part extended through the low pressure blading of the bleeder turbine and exhausted into a condenser. In this way none of the energy of the heating system due to the difference of pressure between the boiler and the heating system is wasted. On the other hand if no steam is required for heating purposes the turbine uses all the low pressure steam and is claimed to operate as efficiently under these varying conditions as under a constant supply of steam.

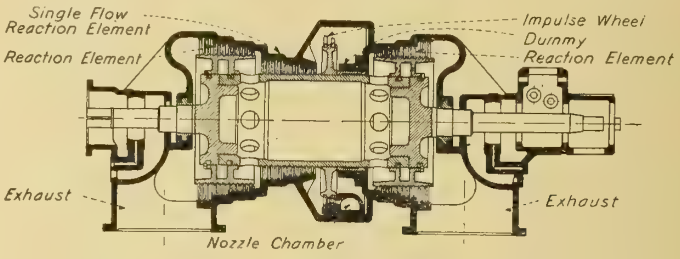


Fig. 4—Section of semi-double-flow turbine

The Ferranti Electrical Company of Canada, Limited

The Ferranti Electrical Company of Canada are now settled in their new home in the Lowes Building, 90 Sherbourne street, Toronto, where the general manager, Mr. Geo. C. Royce, reports business coming in briskly, with splendid prospects for the new year. The company is occupying two full floors in this large building, which are being fitted up in such a way as to facilitate business and give the customer the greatest possible information on the equipment he is purchasing. For example, switchboards will be set up as in a power house, equipped with all the necessary instruments. A very large stock of meters of the well-known Ferranti type will be carried at all times, the storage room being supplied with shelving for 5,000 meters. This company has been very happy in its choice of location on Sherbourne street, being such that out-of-town customers can drop off the Belt Line cars right at their doors.

Motor Equipment of Ontario Paper Co.

The Ontario Paper Company are pushing actively the work of construction on their large development at Thorold, Ont. This plant will be one of the largest of its type in the country when completed. Contracts have recently been awarded for the entire equipment, both mechanical and electrical. The motors for driving the grinders are being manufactured by the General Electric Company of Sweden and supplied through Messrs. Kilmer, Pullen & Burnham. There will be five large induction motors, each of 2,000 h.p., 11,000 volt, 3-phase, 25 cycle, 250 r.p.m. These will be direct connected to the grinder shafts by means of leather band flexible couplings supplied with the motors. It is hoped that the work will be sufficiently advanced for the plant to be put into operation early in the year 1913.

The Electrical News is published Semi-monthly. Advise us promptly if you do not receive your copy.

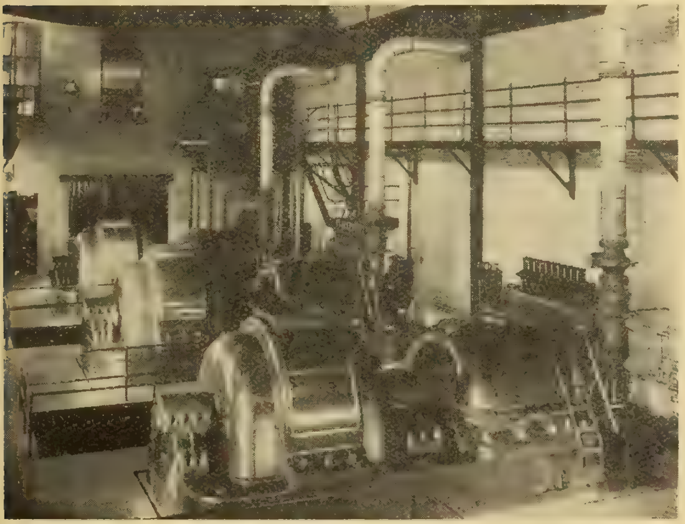
New Auxiliary Steam Plant of W.E.R. Co.

Stand-by Capacity Now 17,000 Kw. or Equal to the Present Hydro-Electric Output. Steam Turbines used with all Modern Labor Saving Auxiliaries

By Mr. E. A. Graham

It is becoming recognized more and more every day that hydro-electric plants, no matter how well built and operated, serve the public best when they are insured by a well equipped with efficient auxiliary plant, the size of which depends on the number of hydro-electric plants tied together, and their relative location to one another, that is, whether located on different watersheds, or whether there is considerable diversity between these plants on the same stream. In the case of a single hydro-electric plant, the auxiliary plant should be of at least half its capacity and preferably greater than that, while in the case of a number of plants on the same or different watersheds where ice, floods or emergency conditions would not be likely to cripple more than one or two at a time, the capacity of the auxiliary plant should be at least that of any one of the plants, and under some conditions much larger.

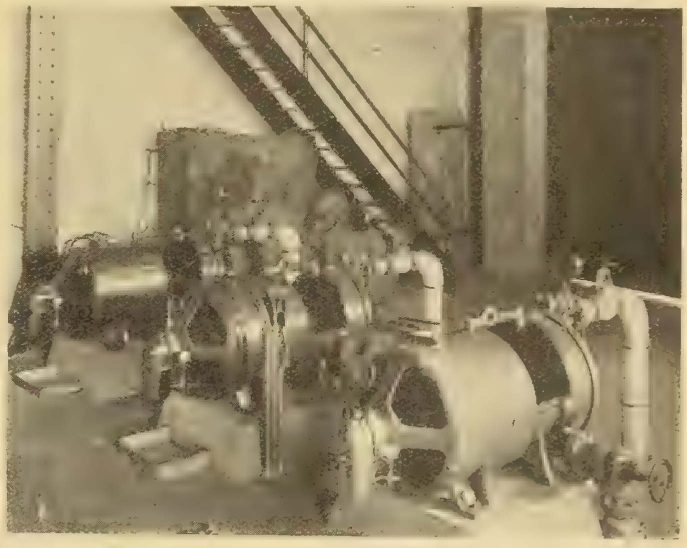
The Winnipeg Electric Railway Company have met this problem by installing a steam turbine plant of a normal rating of 9,000 kw., continuous overload rating of 12,000 kw., which with their original steam plant of 5,000 kw. capacity, gives an available steam plant output of 17,000 kw. for a hydro-electric plant of 14,000 kw. normal rating, but which will easily carry a peak load of 24,000 kw. The power consumers of this company are therefore fully insured against any lengthy power interruptions. The use of steam turbines was finally decided on after a careful consideration of other prime movers available as offering the simplest, most reliable, and ultimately the most economical installation under the conditions of operation to be expected in Winnipeg.



Turbo-generators in new plant of W. E. R. Co.

After the decision to build the plant was made late in January, 1911, the consulting engineers, Pratt & Ross, commenced the preparation of the plans, and coincident with the preparation of the plans, the work of excavating for the foundations, condensing water intake, etc., were carried on in early February, when the ground was well frozen. The most efficient method found for excavating this frozen ground was by means of a huge chisel connected to a pile driver hammer, and carried in leads in a travelling car. This is an invention of Mr. Wm. Hurst, a Winnipeg contractor, and is very effective. The steam station is located in the rear of the terminal station for the transmission lines from Lac du Bonnet hydro-electric power plant, which is about three hundred feet from the Red River. It was necessary to go to this river for the water for the condensers and the make-up water for boilers.

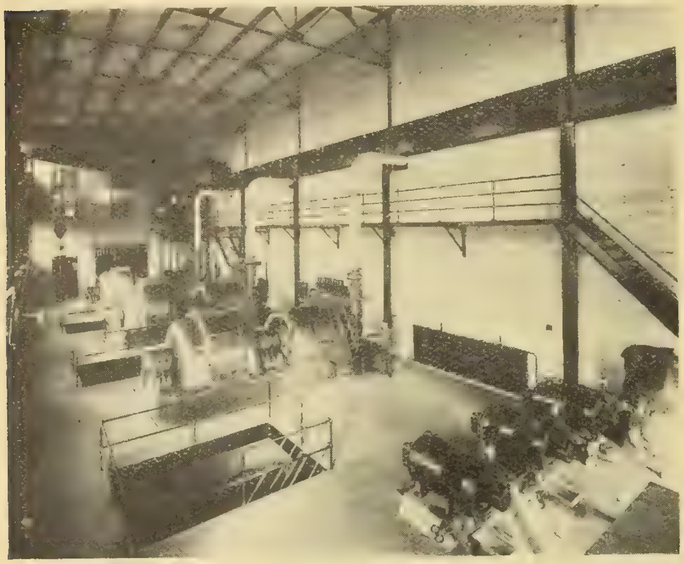
The excavation of the pump pit for the circulating pumps and the conduit for condensing water proved the most difficult problem of the construction work of the plant. This pump pit is 19 feet wide by 50 feet long and the excavation was carried to a depth of 40 feet below the surface of the ground, all of which distance with the exception of the last three feet (a stiff blue clay) was through treacherous quicksand. The engineers used a very ingenious method of timbering, however, and made their excavation and put in their concrete with no mishaps whatever. From the bottom of the pump pit it was necessary to run a duplicate concrete conduit, one for the circulating pump intake, and the other for the condenser discharge, and this had also to be run through the quicksand. The difficulties were further aggravated by the fact that the conduit had to be driven under six railway transfer tracks in constant use. Each of these conduits is of 16 feet cross-sectional area, and leads into an intake which extends out under the river a distance of 50 feet, where it is protected by a built-up screen of ½-in. by 2½-in. iron.



Turbo-exciters in W. E. R. Co's. new plant

On the river bank is a reinforced concrete screen house where the water again passes through screens, which are of galvanized steel of ½-in. mesh. The intake from the river enters at two points, each controlled by sluice valves, so that it is possible to get at either for repairs or cleaning. As before noted, the intake conduit is carried below the floor of the pump pit, and the suction connections are made directly to the pump through the concrete floor by an expansion sleeve which absorbs all vibrations from the pump. The pumps are located at such a level that even at the lowest stages of the river the shells are half full of water, and as an additional precaution in quick starting they can be primed by means of a connection from the hot well, or by suction from one of the vacuum pumps. Absolutely no seepage has been found to come in through the concrete walls or from the intake conduit connections.

The foundation proper for the building is of reinforced concrete on tamarack piles driven 45 feet to rock and cut off below the line of saturation and capped with concrete.



General view generators, exciters, switchboard &c.

Twisted bar reinforcement is used in walls, beams and columns, while the floors are of the arched type with Ferro-inclave reinforcing. The foundations for the turbines, which are of the horizontal type, are carried below the basement floor and do not touch the rest of the building, so that any vibration in the turbines is not so likely to be communicated to the floors and other parts of the building. The hot well is also of concrete, and the ash pits are lined with fire brick.

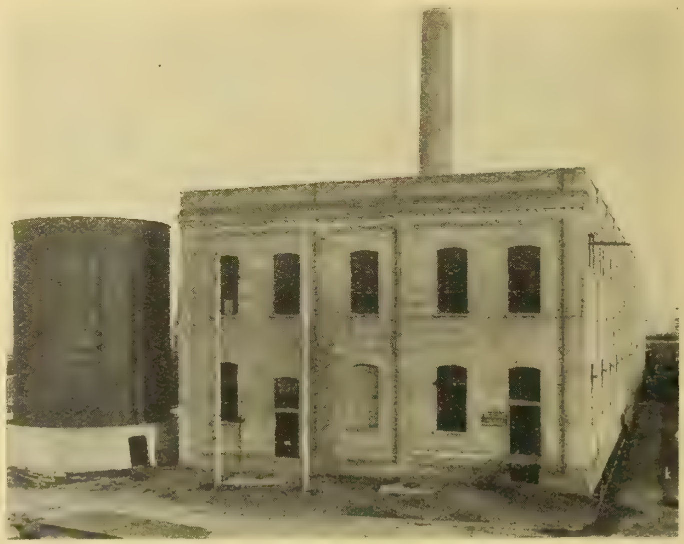
The superstructure is of steel construction tied in with steel superstructure of the sub-station adjoining. This structure has to carry the 45-ton crane and in the boiler room the 900-ton coal bin. The exterior walls and partition wall between boiler and turbine rooms are of local brick. The west wall of the turbine room and part of the boiler room is formed by the exterior wall of the Terminal Station, into which it opens through archways. The roof slab is also of concrete with Ferro-inclave reinforcing and, to avoid condensation on the under surface, a double roof is provided with an air space and a tar and gravel cover. This has proven very satisfactory under severe conditions. The windows are of Fenestra steel sash with wired glass and all doors are of the fireproof type. The over-all dimensions of the plant are 121 ft. 0 in. x 115 ft. 0 in.; the turbine room is 36 ft. 0 in. x 114 ft. and the boiler room 81 ft. 0 in. x 114 ft. 0 in.

Every precaution was taken to make the building and foundations safe and enduring, and in the selection of the apparatus for the interior of the plant, dependability was the essence of the contract, with all due regard for a high economy, necessary with fuel so expensive as it is in Winnipeg. There were therefore selected as will be noted below, Curtis horizontal steam turbines, Babcock and Wilcox boilers, Roney stokers, steam turbine driven exciters and circulating pumps, and feed pumps, and the highest grades of high pressure piping and fittings.

Coal and Ash Handling Equipment

In the West, the practice is to ship coal in box cars from the coal docks at the head of the Great Lakes, the box cars being used on the return trip for handling grain. This necessitates a different method for unloading than can be used in the East where dump bottom gondola cars are available. A motor driven Clark shovel, which in operation resembles a team driven scraper as much as anything else, is used for pulling the coal along the car floor to the door, whence it falls into the receiving hopper. This cuts down considerably the amount of manual labor needed for unloading a car. From the receiving hopper the coal is carried by a 30 inch apron feeding conveyor, 45 feet long at a speed of 30 ft. per min. to a Link Belt boiler house crusher with hard iron rolls 24 in. diameter by 24 in. face. These will break run-of-mine coal to 1¼ in. cubes and smaller, and will by-pass fine coal around the rolls. This is driven by a 15 h.p., 220 volt, three phase motor. The coal drops from the crusher into a Peck over-lapping pivotted bucket carrier, 114 feet long between horizontal centres, and 60 ft. vertically. This conveyor is motor operated with means for controlling its movement either from the crusher or from the conveyor motor up in the cupola. The crusher is located in the basement under the firing aisle between the boilers, and the conveyor runs up the wall at either end of the boiler room and dumps the coal into the bin, suspended directly over the firing aisle. A travelling dumper is provided so that the coal may be dumped at any place in the bin. The ashes are also handled by this conveyor, being raked from the ash pit into chutes emptying into the conveyor, and the stationary dumper at the top dumps the buckets into a chute which carries the ashes outside to a holder mounted over the railway siding. The capacity of the conveyor is 40 tons of bituminous coal received as run-of-mine or slack per hour. Ashes may also be handled at the same rate. The conveyor and crusher equipment were supplied and erected by the Link Belt Machinery Co.

The bin used for the coal storage is of the suspended type erected by the Brown Hoist Machinery Co., and is of reinforced concrete construction. Ribs of ½ in. x 4 in. steel are rivetted to special girders in the steel framework of the building, being allowed to take their natural curve (approximately that of a parabola) and to them are fastened the sheets of Ferro-inclave reinforcing, on both sides of which is plastered a thick coat of cement. Metal chutes with chain operated gates carry the coal to the stokers. The working of the entire coal handling equipment is characterized by a comparative freedom from the noise found in other plants.



Terminal station and auxiliary steam plant.

There are installed at present ten Babcock and Wilcox water tube boilers set in two rows. The boilers are set separately with a passageway between them, and they each require a space of 23 ft. 6 in. x 15 ft. 5 in.

This method of setting, while requiring a little more room, is to be preferred for wide boilers, such as are used in this plant, on account of the improved facilities for cleaning and inspection. The boilers have a nominal rating of 651.5 h.p. and have a heating surface of 6515 sq. ft. Each boiler comprises 21 sections each with 14 tubes, 4 in. diameter and 18 ft. long expanded into wrought steel staggered headers, and three steam and water drums each 42 in. diameter and 24 ft. 7 in. long. A mud drum at the back of the boilers is provided with hand holes and two blow-off connections running into a main which discharges into the overflow at the gate house. The boilers are for operation at 200 lbs. pressure and are tested to 300 lbs. They are guaranteed to evaporate 30,500 lbs. of steam per hour from and at 212 deg. F. Each boiler is provided with six pop safety valves 2½ in. diameter. One of the accompanying illustrations gives some idea as to the arrangement of the boilers, stokers, etc. It is quite difficult to get a photograph that will do this part of plant full justice. For stoking the boilers there are provided ten New Model Roney stokers, manufactured by the Westinghouse Machine Co. These stokers are provided with removable fuel plates.

With fuel of 14,000 B.t.u. content, stokers are supposed to develop 150 per cent. of full rated capacity of boiler, based on 10 sq. ft. of effective heating surface per h.p. with a draft of ½ in. of water. At or near their rating, stokers are capable of causing the evaporation of 10.2 lbs. of water per lb. of dry coal. There are 127 feet of grate surface, giving a ratio of 1 ft. of grate surface to about 51 ft. heating surface. This type of stoker was adopted on account of its flexibility in picking up and handling emergency loads, and on such loads, both boiler and stoker have given good results. The stokers are driven by four Westinghouse vertical stoker engines, operated at 100 lb. steam pressure.

The superheaters are of the Foster patent corrugated type, and will deliver to the turbines, 22,476 lbs. of steam per hour at 200 lbs. pressure, 125 deg. superheat.

The feed pumps, of which there are three, are four stage Mather and Platt turbine pumps with phosphor-bronze impellers and guide tips, and are direct-connected to 50 B.h.p. non-condensing single-stage horizontal Curtis steam turbines, running at 2500 r.p.m. Each of these pumps is capable of delivering 130,000 lbs. of water per hour for 3 hrs. overload, and 89,000 lbs. of water at normal load against a pressure of 200 lbs. The suction pipe is 5 in. in dia. and the discharge end 4 in. When in service they are run constantly, the governors admitting only sufficient steam to keep the set up to speed, water being pumped into the boilers directly the valves are opened. The feed pumps are located in an annex to the boiler room on the basement level and are very accessible to the attendants.

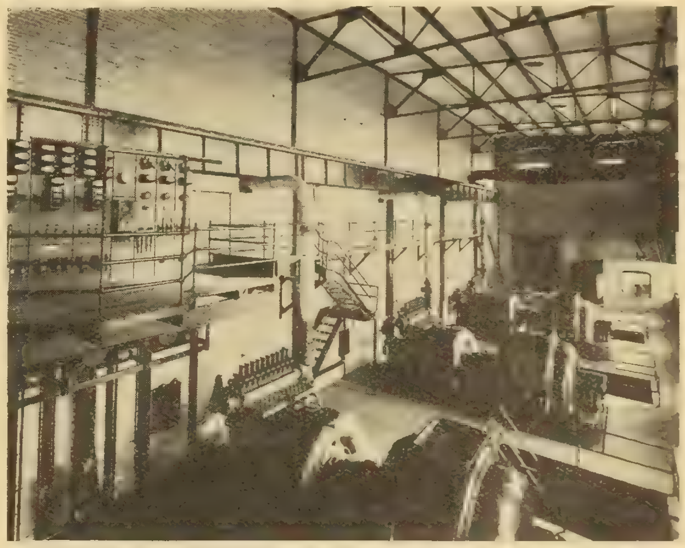
The smoke and waste gases discharge directly from the back of the boilers into sheet steel breechings, the draft being hand-regulated by butterfly valves on ball bearing shafts. These breechings run the length of the boiler room and on either side, and discharge the gas into a Kellogg reinforced concrete chimney. This chimney which is the largest in Canada, was erected at the rate of six feet per day, which is excellent time considering the materials to be handled. It is 256 feet high, 24 ft. in diameter at the bottom, and 14 ft. in diameter at the top. The thickness of the wall varies from 14 in. at the bottom to 6 in. at the top and there is a uniform taper of 1 inch in 25 ft. The foundation, which is a reinforced concrete matt 35 ft. square and 6 ft. deep, rests on 169-45 ft. tamarack piles spaced 2 ft. 9 in. on eentres. The vertical reinforcing is iron bars. bent at right angles to tie into the foundation reinforcing, and tied in with No. 23 wire mesh for circular reinforcement. There is a lining of fire brick for a distance of about 50 feet above the flue openings, the two breechings are separated by a baffle wall 9 in. thick and there is a concrete floor 2 ft. below flue openings. Pyrometer and draft gauge connections are provided.

The chimney is provided with an outside ladder and ample protection in the way of lightning rods, there being eight ¾ in. copper points tipped with 1½ in. solid platinum, and connected to a large copper ground plate by a No. 4/0 cable.

Piping

As the bus bars, oil switches and connections are to the electric plant, so the piping and valves are to the steam plant, and a failure anywhere is liable to be fatal unless proper provision is made for the isolation of sections in trouble without crippling the remainder of the plant by so doing. In this plant, the 7 in. connections from each boiler pass through valves into an 8 in. loop main, which is however enlarged to a 10-in. header on the side nearest the turbine connections. There is also an 8 in. cross connection along the ceiling of the boiler room from one side of loop to the other, and the main is sectionalized by hydraulicly operated gate valves so placed that not more than three boilers can be cut out by trouble at any place. These valves are operated by force pumps located on the boiler room floor.

The steam and water mains to the feed pumps are in duplicate so that two pumps are always available for use.



Nearer view of switchboard, W.E.R. Co's. auxiliary plant

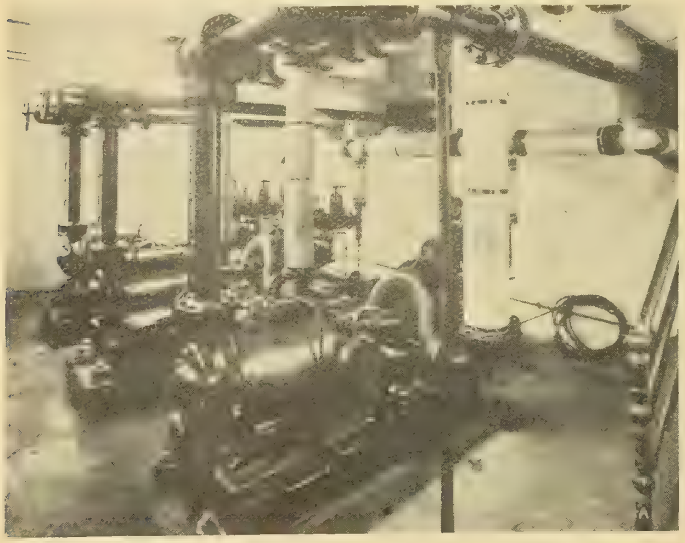
The feed water connections to the boilers are also in duplicate. As all of the auxiliaries are non-condensing, their exhaust steam is piped to the two Worthington high pressure closed vertical heaters, each of which has a heating surface of 450 sq. ft. in ¾ in. tubes, and a capacity of 89,000 lbs. of water per hour from 80 to not less than 205 deg. F. when supplied with not less than 8500 lbs. of exhaust steam per hour at atmosphere. These were supplied by the Alberger Condenser Co.

The steam line is effectively drained at various points by pipes leading to Bundy tank traps, returning the water to the hot well. The high pressure piping was supplied by the Babcock and Wilcox Co. and the high pressure valves by them and by the Crane Co., who also supplied a large part of the low pressure piping.

In addition to the hot well with its duplicate tanks, there is an L. R. Booth water softening plant of 4000 gallons per hour capacity installed alongside the hot well.

Turbo-Generators and Auxiliaries

The generating equipment consists of three six stage horizontal Curtis steam turbines direct coupled to 3000 kw., three phase, 60 cycle, 1800 r.p.m. alternators. These sets have a continuous overload rating of 4000 kw. The speed regulation of the turbines is 2½ per cent. for ranges, in load, from full load to no load, and the generator regulation under the same conditions is 14 per cent. The generators are intended for use with Tirrill regulators. The turbine governors are hydraulicly operated, using oil under 100 lbs. pressure, while the circulating oil for the bearings is under about 25 lbs. pressure. The bearings are still further cooled by water coils imbedded in the babbitt. The generators are entirely enclosed, save for the air intake at the bottom and the outlet at the top of the generator frame. Carefully screened air is brought in from outside the building through a well lagged metal duct. 18,000 cu. ft. of air per minute at 65 deg. F. is required for cooling a generator at maximum load conditions. The guaranteed steam consumption for 3000 kw. output at 200 lbs. pressure and 125 deg. superheat and 2 in. absolute vacuum is 11 lbs. of steam per h.p. hr. They each require a floor space of 24 ft. 5 in by 10 ft. 0 in. and stand 8 ft. 5 in. high.



Turbine feed pumps, W.E.R. Co's. auxiliary plant

Excitation is furnished by three 50 kw., 3600 r.p.m., 125 volt interpole generators, direct coupled to single stage horizontal Curtis turbines.

The condensers are located in the basement with their main axes parallel to that of the turbo-generator, and the exhaust connections from the bottom of the turbine are made in the side of the condenser by a 48 in. elbow, from which there is a 24 in. Y connection and elbow up to a Cochrane automatic atmospheric relief valve for exhausting to the atmosphere in case of failure of vacuum. The exhaust connection is an 18 in. galvanized pipe with an 18 in. exhaust head on the roof.

The condensers are the Wheeler surface type with 9000 sq. ft. cooling surface in ¾ in. seamless drawn brass tubes. The shell is 7 ft. 2 in. in diameter and tubes are 10 ft. 2 in. long. The vacuum is maintained by three Mullin horizontal suction valveless double acting crank and fly wheel pumps. They run at a speed of 105 r.p.m. and develop about 21 h.p. each with 1100 lbs. of steam per hour. All of these pumps are connected to the same suction main so that a breakdown of one will in no way cripple the plant, for the remaining two will maintain the vacuum at maximum load conditions. These vacuum pumps may also be used to prime the circulating pumps. The vacuum pumps have to pump against a head of about ten feet into the hot well or softening plant.

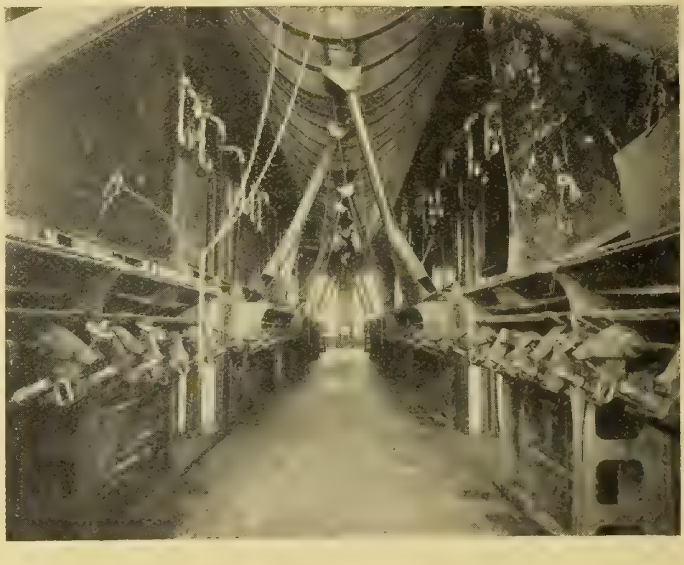
The condensers are guaranteed to condense 72,000 lbs. of steam per hour at a vacuum of 2 in. absolute with 8000 gallons of circulating water per minute at 65 deg. F. As before noted the circulating water pumps are at the bottom of the sub-basement. There are three of these, each of the horizontal volute type 18 in. turbine pumps built by the I. P. Morris Co. The impellers are of bronze composition and specially designed throughout for operation at high speeds. They are provided with ring oiling bearings and water sealed stuffing boxes on shafts. The suction chamber of each is on the lower side of the case, and the discharge to the circulating water main is at the top. The pumps are direct coupled to 100 h.p. 24 in., 8 stage, 900 r.p.m. Kerr turbines. There is also in this pit a duplex pump with 4 in. discharge which is normally used for emptying drainage sump, but which may be used for priming circulating pumps, for pumping water to flush out boilers, or for supplying make-up water.

All of the principal auxiliaries are of sufficient capacity for any two to serve the plant when running at full rated output, leaving a third for a spare, and it will also be noted that they are all of the turbine type except the air pumps.

Switchboard

In keeping with the remainder of the equipment, the switchboard is as simple and free from complications as is consistent with safe operation. It is mounted on a gallery above the turbine floor, and on a level with the switchboard floor of the main distributing sub-station, to which there is access through a large archway. The switchboard is of natural black slate finish and comprises a total load panel, three turbo-generator panels, Tirrill regulator panel, and three exciter panels. On the total load panel there is at present ammeters showing the total load delivered by the steam plant, and the ampere load on the transmission lines from Lac du Bonnet.

On the generator panels are the a.c. ammeters, power factor meter, field ammeter, indicating wattmeter, integrating watthour meter, a.c. voltmeter, and the necessary control switches and indicating lamps for the electrically controlled field switches, main oil switches, field rheostat, and turbine governor control motor, so that the operator has complete control of the machines and switching with the fewest possible motions. The generators are paralleled with the



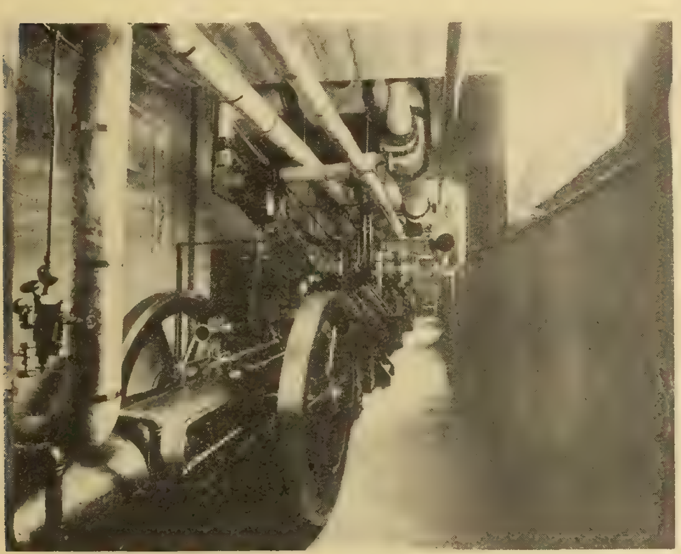
Boiler room, W.E.R. auxiliary plant

2200 volt bus-bars of the terminal station through oil circuit-breakers in a switch room adjoining the switchboard. As this room is at the extreme end of the sub-station bus-bars and it was impossible to increase their capacity, a new set of bus-bars was built from these switches to the bus tie switch of the old structure, where they may be connected, by disconnecting switches, to either side of this bus tie switch.

The generators are protected by reverse current relays and over-load inverse time limit relays. Instead of tripping out the oil switches, however, these relays close a loud ringing gong relay which calls the operators attention to the trouble. Ordinarily when operating in parallel with Lac du Bonnet, the Tirrill regulator at that station regulates the voltage, and its governors are set so that they take most of the peaks. As a consequence, the voltage curve in the sub-station is very even. The extensive use of synchronous motor-generator sets on the system gives a load on the transmission line of very high power-factor, and the regulation is therefore very good.

Station Lighting

One hundred watt tungsten lamps are used quite generally for lighting, being mounted on the roof trusses of the turbine room with intensifying shades and giving a very uniform and satisfactory light. Their maintenance is very low. In front of the switchboard it may be noted that an eight foot "Lin-o-lite" is mounted on pipes which are a part of the railing. This gives a very satisfactory light, it being uniformly distributed on the board and there is no glare in the floorman's eyes when watching for signals from the operator. An intercommunicating telephone system is used to connect the various important parts of the two stations.



Reciprocating vacuum pumps, W.E.R. Co's. auxiliary plant

Work on the plans for this plant was first commenced in January 1911, and the first unit of the plant was put in operation Dec. 23, 1911. The excellent time made in the erection of the plant may best be appreciated by those who are familiar with the extremely severe climatic conditions existing in the early spring and late fall in Winnipeg, and the difficulty experienced in securing delivery of material on so short notice. The plant has been pronounced by one of the most eminent electrical engineers on the continent as being the best designed and most economical stand-by plant he has inspected.

The consulting engineers were Messrs. Pratt & Ross, and H. Edwards of Winnipeg, under whose direction all of the work of construction was carried on. In the elaboration of the design, details of construction and operation were carefully worked out in conjunction with the officials of the Winnipeg Electric Railway Company, Mr. Wilford Phillips, manager, Mr. Wilson Phillips, general superintendent, and Mr. C. R. Ross, electrical engineer.

Personals

Mr. W. K. Jeffrey, manager of the Ottawa Car Co., is making an extended western trip through to the coast.

Mr. J. F. B. Vandeleur has resumed business in the Dineen Building in electrical supplies, as originally carried on by him.

Mr. W. E. Skinner, of the W. E. Skinner Company, Limited, has gone south again this winter on account of ill-health.

Mr. Jno. W. Moyes has been engaged by the Toronto city council to prepare a report on a suburban railway service.

Mr. G. C. Burnham of the firm of Kilmer, Pullen and Burnham is in Sweden in connection with the business of his firm.

Mr. W. F. Kelly, formerly chief of the Ontario sales department of the Canadian Tungsten Lamp Co., has been transferred, temporarily at least, to British Columbia.

Mr. G. A. McNamee, for several years assistant secretary-treasurer of the Montreal Tramways Company, has resigned. Before leaving he was presented by Mr. Dubee, on behalf of the staff, with a very handsome clock.

Mr. C. F. Beames, general manager of the Nipissing Central Railway Company, previous to its purchase by the government to form part of the T. & N. O. railway system, is now chief electrical engineer to the Government of Mysore, India.

Mr. H. C. Barber, up to the present time assistant chief engineer to the municipal hydro-electric system in Hamilton, Ont., has been appointed assistant manager of the Toronto Hydro-electric System and assumes his new duties on January 1st.

Mr. W. C. Freeman has resigned his position as manager of the Ontario branch of the Stromberg-Carlson Telephone Company and accepted a similar position, with headquarters in Toronto, with the Century Telephone Construction Company of Buffalo and Bridgeburg.

Mr. E. S. Cook, formerly of the Westinghouse Electric & Mfg. Co., has been engaged by the Canadian Tungsten Lamp Co., of Hamilton to look after their interests throughout the province of Ontario. He is now busily engaged drumming up trade and reports splendid prospects.

Mr. Gordon Kribs, a '05 graduate of the Faculty of Applied Science of the University of Toronto, formerly in the electrical department of Smith, Kerry & Chace, and later assistant to the chief engineer of the Pacific Power & Light Company, Portland, Ore., has been appointed assistant to the chief engineer of the Texas Power & Light Company, Dallas, Texas.

Dinner of University of Toronto Engineering Alumni

On December 17th the Engineering Alumni Association of the Faculty of Applied Science of the University of Toronto held their annual dinner, Mr. J. C. Armer presiding. The discussion dealt chiefly with the research work to be done by Messrs. Dobson and Shaw during the next year. As mentioned recently in the Electrical News, Mr. Dobson's work will deal particularly with the study of conditions on high tension transmission lines in which he will have the co-operation of the Ontario H. E. P. Commission.

Miscellaneous Cost Data

Installing Insulators

Putting 100 centre groove, porcelain insulators on span wire to carry No. 10 T. B. W. P. iron telephone wire. A tower wagon with boxes on top was used for this purpose, putting two insulators on one span and tying each insulator to the 5/16-in. messenger wire with a tie of 8-in. No. 10 T. B. W. P. iron wire.

One foreman, 9 hours	$2.66
One lineman, 9 hours	2.50
One groundman, 9 hours	1.75
One team, 9 hours	4.00
Total	$10.91
Amount per span	.218
Amount per knob	.109

Shaving and Roofing Poles

5-in. x 20-ft. cedar telephone poles	$ .33
Add $ .04 for board of men	.04
Total	$ .37
6-in. to 7-in. x 30-ft. cedar trolley poles	$ .661
Add $ .022 for board of men	.022
Total	$ .683
7½-in. x 35-ft. cedar trolley poles, used at railroad crossings, total	$1.25

Painting

Painting 70 breasters (rough all over) 3-in. x 12-in. x 4-ft., No. 1 hemlock, with one coat of carbolineum avenarius.

One man, 5 hours at $ .19 4/9	$ .97
4 gal. preserver at $ .70	2.80
¾ gal. gasoline at .16	.12
Total	$3.89
Price per breaster	$ .056

Bonding

Four men, 25 compressed terminal bonds a day, 12½ joints, continuous rail joints, digging out joint, taking off joint, reaming 4 holes, putting in bonds, putting on plate,—cost each, $ .29.

Drawing Earth

Drawing dirt by means of wagons, each wagon holding over 1 cu. yd. Laborers wage equals $ .16 per hour, hire of team $ .40 per hour.

No. of loads	Total Cost	Distance	Cost per load
98 loads	$33.50	1100 ft.	$ .342
135 loads	46.60	1150 ft.	.345
146 loads	56.73	1000 ft.	.388
230 loads	63.76	800 ft.	.277
218 loads	71.73	800 ft.	.329
247 loads	75.69	700 ft.	.364
158 loads	51.43	550 ft.	.325
Average, 176 loads	57.06	871 ft.	$ .338

Distributing Ties

Distributing dry cedar ties (50 per station) on right-of-way. The gang consisted of three teams. Two teams were of a good standard type of draught teams, No.'s 2 and 3, No. 1 being about 85 per cent. of standard type. The wagons were 3-inch tire with flat platform top. The work first described was that of drawing a distance of 2¼ miles. ¾ of a mile of this was quite a deep sand and gravel. 1½ miles was generally level. Average condition of roads 90 per cent. of good. Ties taken from railroad freight car. Four trips made in one day.

No. 1 team delivered 220 ties at 2¼c each	$4.95
No. 2 team delivered 240 ties at 2¼c each	5.40
No. 3 team delivered 240 ties at 2¼c each	5.40
Total, 700 ties	$15.75

Another day, same teams and wagons, roads better, smooth and frozen, distance 3¼ miles. Ties taken from car, 8-ft. dry cedar ties.

No. 1 team drew 3 lds. (60 ties ea.) 180 ties at 2¼c. ea.	$4.05
No. 2 team drew 3 lds. (65 ties ea.) 195 ties at 2¼c. ea.	4.29
No. 3 team drew 3 lds. (65 ties ea.) 195 ties at 2¼c. ea.	4.29
Total, 570 ties	$12.63

Conditions same as above, excepting the length of ties being 9 feet; taken from pile; distance, 3¾ miles.

No. 1 team drew 3 lds. (55 ties ea.) 165 ties at 2¼c ea.	$3.71
No. 2 team drew 3 lds. (60 ties ea.) 180 ties at 2¼c. ea.	4.05
No. 3 team drew 3 lds. (60 ties ea.) 180 ties at 2¼c. ea.	4.05
Total, 525 ties	$11.81

Same three teams drawing 8-ft. dry cedar ties, distance 1 mile, medium condition of roads, ties taken from car.

No. 1 team drew 5 lds. (55 ties ea.) 275 ties at 2¼c. ea.	$6.19
No. 2 team drew 5 lds. (60 ties ea.) 300 ties at 2¼c. ea.	6.75
No. 3 team drew 5 lds. (60 ties ea.) 300 ties at 2¼c. ea.	6.75
Total, 875 ties	$19.69

Grubbing Trees

A certain swamp oak, 32-in. diameter, having a very heavy limby, spreading top and a height of 35 feet, growing in the open, in a water sag on a black loam and muck soil and blue clay subsoil; to grub out and trim, required 3 good men, 10 hours each, total 30 hours, at $1.75 per day, $5.25.

Unloading Tie Plates

Four Italians spent a total of 23 hours labor to unload from two box cars, 2,645 bales of tie plates, each bale contained 10 plates and weighing an average of 46 pounds; average work per hour, 115 bales. The bales were thrown from car door into a pile by side of the track. Total cost at $1.75 per day, $4.03.

Applying Bonds

Cost of applying ⅞-in. semi-plastic brown alloy bonds on grooved rail. A vertical electric drill, drilling a hole through the groove of the rail into the fish plate, was used and an average of 50 bonds were installed in a working day of ten hours. The rate of wages was as follows:

Foreman, $2.50 per day	$2.50
Four laborers, each $1.50 per day	6.00
Power	1.50
Total	$10.00
Cost of labor, superintendence and power, $ .20 per bond.	
Cost of bond, delivered	.42
Total cost, per bond applied	.62

The Ontario Railway and Municipal Board have ordered two extensions to the Toronto Suburban car lines in West Toronto, now known as Ward 7. The total length of the two lines is slightly over two miles. The order calls for a single track laid a little to one side of the centre line, so as to allow of double tracking when the traffic warrants it.

Canada's Prosperous Prairie Province

The Situation in Moose Jaw—A Most Modern and Complete Powerhouse and Plant.

The following extracts taken from the report of the Electrical Department for the city of Moose Jaw, for ten months ending October 31, 1912, are indicative of the phenomenal recuperative powers evidenced to-day in Canada from coast to coast. Destroyed by fire May 25, in full swing 65 days later and with entire deficit wiped out in seven months, is a record any city may well be proud of:—

Owing to the increase in the number of consumers during the years 1910 and 1911, of 114 per cent. an increase of current sold during the same period of 169 per cent., and the increase of peak load of 125 per cent., the first problem that faced the 1912 council regarding the Electrical Department was the increasing of the capacity of the plant. After thorough consideration it was decided to raise by by-laws the sum of $225,000 for this purpose, $113,000 of which was to be used for extensions to the power plant and the balance for line extensions, street lighting, meters, transformers, etc. Accordingly plans and specifications for the new equipment, buildings, and material were prepared and contracts awarded, the principal among which were as follows: Babcock & Wilcox Co. (boilers and stokers) $26,400; Canadian General Electric Co. (turbo-generator) $28,700; B. F. Sturtevant Co. (economizer and draft equipment) $10,300; Babcock & Wilcox Co. (coal and ash handling equipment) $9,500; Dawson & Co. (line material); James Stuart Electric Co. (line material); Eugene Phillips (copper wire); Johns-Manville Co. (lamp standards).

When plans were all in readiness and work was about to be started on the extension to the building, the old plant was destroyed by fire (May 25th) and all the plans rendered useless. When this occurred the situation was very serious indeed. The water works department were without power to operate pumps; industrial concerns operating on electric power were obliged to shut down, at least until some temporary arrangements were made; the streets were in darkness, and all residences without lights.

Only Three Hours Delay

Within three hours of the starting of the fire steps were being taken to restore service to water and light consumers and to furnish fire protection. A steam pump was obtained from the Robin Hood Mills and within sixty hours of the time the fire started, this pump was installed, the boilers got into operation again and the supply of water restored. In the meantime the telegraph wires were in search of electrical machinery either new or second hand and of any type. After waiting several days and receiving several propositions, it was decided to accept one from the Canadian General Electric Co. which was to supply a new three-phase outfit on the contract previously awarded them for a two-phase machine. This machine was shipped within ten days from Lynn, Mass., and in about sixty-five days from the date of the fire was put into operation on its permanent foundation in the new plant. During this interval a 150 kw. machine had been fitted up by the Robin Hood Mills and was giving a very limited service to power consumers. Also during the interval plans had been prepared for an entirely new building and plant, and contracts awarded. The debris had been cleared away and excavations and foundations started. Owing to the necessity of operating the plant during building operations, and the liability of large extras and trouble with the contractor it was decided to do this work by day labor. Work was commenced on clearing the debris and excavating for the new building on June 14th. The plans approved by council comprised an engine room 86 ft. x 50 ft. with 32 ft. walls and 10 ft. basement; boiler room 100 ft. x 86 ft. separated from engine room by a fire wall; pumping station and offices, and dressing rooms in a separate building 40 ft. x 60 ft., all to be of brick and steel construction, and fireproof. The new buildings were laid out to suit the location of the old boilers, thus permitting them to be operated during construction.

The buildings were also laid out to accommodate all the latest fuel and labor saving devices and a plant sufficient for a capacity of 3000 kilowatts or three times the present requirements. In addition to this the entire plant and buildings are designed for an extension which will give an ultimate capacity of 9000 kilowatts.

Provision is also made for coal and ash handling apparatus and other labor saving devices which when completed will reduce the pay roll by about $25 daily. Overhead coal bunkers are provided with capacity of 600 tons; also an ash bunker of 30 tons capacity, and a track hopper into which coal can be dumped direct from railway cars. In laying out the plant every precaution has been taken to make it convenient and capable of constant operation without interruption.

Local Firm Supplied Steel

The construction of the building called for a large amount of structural steel. As soon as possible tenders were called for this and only three were received. The earliest shipment offered was four months which would have been November 15th. Negotiations were entered into with the local Bridge & Iron Works and the contract awarded to them on a basis of cost plus 10 per cent. They guaranteed the cost not to exceed the amount of the highest tender and were given the privilege of substituting stock material for that called for on the plans, if necessary to get rapid delivery. By this arrangement sufficient steel to allow building operations to proceed was delivered on the site in less than one month. Building operations were later delayed at different times awaiting the delivery of structural steel. Scarcity of labor has been quite a handicap, but greatest delays have been on account of the slow deliveries of material.

Previous to the fire the system of generation and distribution was what is known as two phase. It was decided to change the system to three phase, which does not require such expensive lines and is generally recognized as the standard of the present time. Some of the power consumers have been caused some inconvenience by this change but it is expected that this trouble will soon be overcome satisfactorily to all concerned.

The fire also destroyed all the station equipments for arc lighting, the value of which was about equal to the lamps themselves. Advantage was taken of this, to install a much more efficient and modern system of street lighting. Instead of purchasing new station equipment for the old type lamps, the old lamps were discarded entirely and in future the city streets will be illuminated by metallic flame arc lamps which give about five times the illumination of the old carbon arc lamps with the same amount of current consumed. Early in the year it was decided to install about ninety additional street lights. Owing to the incomplete condition of the power house and the lack of accommodations for station equipment these lamps have not been added as yet but will be very shortly and when this is done every portion of the city will be extra well lighted.

Early in the year 1912 it was decided to change the system proposed for the main street to tungsten clusters. This system is now installed. The ornamental lighting on side streets will be ready for operation by the time the power house is in condition to handle this load which will be before the new year.

Regarding line extensions, this work was very late getting started, as most of our poles, wire, and other line material which was ordered in March for delivery in May, did not arrive until the month of August. However since that time this work has been rushed as much as possible and at the present time there are only two or three extensions to build to serve all the houses for which connection has been applied for. There is still a large amount of rebuilding of lines to do to provide for a very large increase of business connected to them. This cannot all be done this year and it is probable that some of the most remote districts will have rather dim lights during the evening hours of this winter. As much of this work will be done as the weather will permit. Good linemen have been very hard to secure and retain during the last summer. A great deal of extra line work was made necessary by changing the system from two phase to three phase. This change had also to be made in a very short time and the work was carried out in a very creditable manner.

The operation of the plant, particularly since the month of July while building operations were being carried on at the same time, has been carried out with great difficulty. To allow the building to proceed and keep the plant in operation at the same time has necessitated all kinds of shifts being made, and this has been done at a cost of thousands of dollars.

Good Financial Statement

At this time last year our boilers were overloaded. At the present time these same boilers are handling over 50 per cent. additional load and doing this without the assistance of condensers which increases the demand for steam by about 30 per cent. During the peak load hours these boilers are working over 100 per cent. above their rated capacity and there is no opportunity to clean them as we have no spare capacity. With boilers operating under these conditions the efficiency is extremely low, and with our steam turbine still operating non-condensing the steam consumption is double, and on lights loads treble, what it would be running under normal conditions. In spite of these facts however you will note by the financial statement that this department shows a deficit of only $6,578.31 which will be entirely wiped out and converted into a surplus by the close of the year. It should be remembered that during ten weeks of the ten months covered by this statement that no revenue whatever was derived from the city plant. This is a very good indication that the action of last years' council in reducing the light rates one cent per kilowatt hour and the power rates to the equivalent of hydro-electric rates in the province of Ontario was not based on guesswork. The rates given in this city are remarkably low when it is taken into consideration that the freight charges on fuel alone are equal to the total cost of a better grade of fuel delivered to steam plants in Ontario and Quebec. Had there been no interruption to the operation of the plant this year it is quite certain that a handsome surplus would have been shown. With the new plant in operation next year the cost of generation will be reduced by at least 15 per cent. and if present rates are not reduced and the increase of business continues at the present rapid rates, the electrical department will be a very considerable source of revenue for the year of 1913.

Owing to the destruction by fire of our total output, meters and other records, the department has lost some very valuable information, regarding losses in transmission, cost of generating per kw. hour, and an analysis of this cost. This information is very valuable in figuring on reduction of rates or quoting special rates to large consumers.

The current sold during the ten months (which was really only seven and one-half months) shows an increase over the same ten months of 1911 of 49.5 per cent. This does not take into consideration the fact that since May 1912 there has been very little street lighting done, the current for which was included in the figures of 1911. The increase of the number of consumers for the first ten months of 1912 was 980 or 49.7 per cent. as against 35.8 per cent. for the same period of 1911.

The gross revenue for this period of 1912 was $100,657.26 as against $78,881.64 for the same period of 1911, an increase of 27.6 per cent., and this increase was made with rates averaging about 15 per cent. lower than in 1911.

The total operating expenses for this period of 1912 were $107,235.57 as against $71,562.84, an increase of 50 per cent. over the same period of 1911. The reason for the large portion of this increase has already been given. From the figures of previous years, with the increase of business experienced this year the operating expenses would not have increased more than 30 per cent. under normal conditions over the same period of last year. Figuring on this basis had the plant been operating under normal conditions during the period covered by this report the financial statement would have shown a surplus of over $21,000.

Winnipeg City Extending Plant

At a recent meeting in Winnipeg of Messrs. Herdt and Kennedy, consulting engineers for the city of Winnipeg's hydro-electric development, the matter of a steam stand-by plant was carefully considered. It was decided not to build such a stand-by plant at present, but instead to commence immediately on designs and construction of a two circuit 110,000 volt transmission line from the power plant at Point du Bois to the city paralleling the present line on the opposite side of the right of way now occupied by a two circuit 60,000 volt line. The reason for the increased voltage of 110,000 is that it will require that voltage to transmit the amount of power remaining undeveloped at their present site, when it is all utilized. Steel towers with concrete footings and suspended insulators will be used. The footings will be put in during 1913 and the line will be ready for service, it is expected, by November 1, 1914. It is not intended to operate the line at 110,000 volts until the power plant building is extended to its final size, which it is expected will be in 1915. For the present it will be operated at 60,000 volts, and the switching at the generating end will be done at an outdoor station located across the tail-race from the power house. There will be added during the coming year two new hydraulic generating units of 6500 h.p. each with switching equipment, and transforming capacity of 9000 kw., which at the generating station will comprise one 9000 kw., 3 phase unit, and at the receiving station, three 3000 kw. single phase transformers.

In the city, the increased load obliges the department to extend the McPhillips street sub-station, and the arc lighting sub-station at May street, and the down-town station on King street. In addition to these extensions there will also be erected a new sub-station in Fort Rouge district which will be served by a duplicate underground 13000 volt feeder. Appropriations of $250,000 for new hydraulic and sub-station equipment and of $700,000 for the transmission line have been made.

A proposal was made by the W. E. Skinner Company, Limited, who are promoting a Central Steam Heating Company, to supply the city with a breakdown service of 10,000 kw., from low pressure turbines. The consulting engineers, while recognizing the merits of the proposition did not make any definite recommendations for the city to participate in the offer, but were emphatic in advising an immediate start on the transmission line.

Collecting Data on Water Powers

The Prairie Provinces' water-powers upon which fairly definite information is available are mostly all confined to the southern portion of the provinces. This is a rather unfortunate coincidence and is likely to mislead the uninitiated regarding the total potentialities of these provinces, as the larger water-powers are situated in the north, on the Athabaska, Peace, Slave, Churchill, Nelson and other rivers. As even a preliminary survey of these rivers will be of great value, the Commission of Conservation has undertaken this work. During the last two summers, its Hydro-Electric Engineer, Mr. L. G. Denis, has been in the field making measurements of flow, height of falls, etc. Last year, the many rapids of the Athabaska river were investigated and the flow of the Peace and other rivers was measured. This year, the work included many long miles of travel, mostly by canoe, the western limit of the trip being the Peace River canyon in the north-eastern portion of British Columbia, while the northern limit was Fort Smith, on the Slave river. On the return trip the several rapids and falls in the Clearwater river and the upper waters of the Churchill were investigated. The general impression created by these large northern water-powers is that they will undoubtedly become of great value in connection with the wood-pulp industry. The raw material is close at hand, the only retarding factor, at present, being the lack of means of transportation and access. The details obtained by these investigations will be included in the Commission's forthcoming report on the "Water-Powers of Western Canada."

Kindersley, Sask.

The town of Kindersley, Sask., are at the present time installing electric generating and distributing equipment for supplying light and power. The plant will consist of a seventy-five kv.a., three phase, 60 cycle alternator, direct connected to a simple horizontal engine of 130 hp. capacity, at 277 r.p.m. The exciter will be belt connected. The plant is being installed in connection with a water-works pumping and filtration plant, the power house being located at the water supply which is about three-quarters of a mile south of the town. Steam will be supplied to the whole plant from two 72 in. x 16 ft. return tubular boilers mounted in battery, with the usual feed water heater and pumping equipment. An additional auxiliary motor-driven well pump in the town is to be operated electrically from this plant and controlled from the power house.

Contracts for this plant were let in August of the present year and the work is now under way, the power house being almost completed and all of the pole line being erected with the exception of the railway crossing. It is expected that the plant will be in operation by the end of January.

The Canadian General Electric Co. have the contract for the generator, switchboard and street lighting equipment. The Robb Engineering Co. are supplying and erecting the engine, boilers, steam piping and auxiliaries, also the steam heating system. The work is being carried out under the supervision of the John Galt Engineering Co., Ltd.

Yorkton, Sask.

The corporation of Yorkton, Sask., has just placed an order with the Siemens Company of Canada for another generator to be driven by a Diesel oil engine. The generator is of 400 kv.a. capacity, 3-phase, 60 cycle, 2200 volt, 200 r.p.m., with direct coupled exciter. This generator will be mounted on a solid bed-plate and be direct connected with a Mirrlees Diesel oil engine supplied through the Canadian Boving Company. It will be remembered that some eighteen months ago Yorkton installed a 80 kw. equipment of a similar nature which has evidently proven sufficiently satisfactory to justify them in their present purchase.

Prince Albert, Sask.

Recently the question of a street railway franchise was discussed by a representative of the Stone & Webster Corporation with the Prince Albert Board of Trade, but as the city authorities consider themselves committed by force of public opinion to the building of a street railway as a public utility, nothing was done. Prince Albert are developing at the present time, as a municipal enterprise, some 15,000 h.p. on the Saskatchewan River, which it is hoped to have completed next year some time. It is the present intention to link in the operation of a street railway with this water power development.

Telephone Progress

Since March 1st, 1912, eighty-four new companies have been formed in Saskatchewan with an aggregate pole mileage of 1366 miles with 1448 subscribers. The total for Saskatchewan now shows 336 rural telephone companies with 7516 pole miles. The total number of subscribers is 7980 which works out to a little over one subscriber per pole mile. The total capitalization is $1,006,035 or about $134 per pole mile and $127 per subscriber. In addition to rural telephone companies, there are twenty-one private independent companies not included in the above. There are also five companies operating under the Municipal Telephone Act which is now suspended.

Rapid progress has been made during the present year in long distance construction by the Saskatchewan government. Three new lines are being built towards the Manitoba boundary which have been completed as far as Marchwell, Fairlight and Welwyn respectively. The long distance line which is under construction along the main line of the C. N. R. westward towards the Alberta boundary has now reached Lloydminster. A similar line paralleling the C. P. R. has been completed as far as Gull Lake. The amount of construction completed since March 1, 1912, is approximately 800 pole miles and 1572 wire miles. This gives a total for the province to date of 2964 pole miles and 9744 wire miles. The number of toll offices opened and purchased to date is 228, and the total number of exchanges built and purchased to date is 80, with 12,802 subscribers.

Although it is the declared policy of the Bell Telephone Company to place gradually all their wires in the Montreal district underground, Mr. Jones, the manager, states that it is practically impossible to do so at the present time in the outlying districts. They therefore have applied to the city for permission to put up poles in places where the population is small. In some instances there are only two or three residents on a long street, and the company naturally do not feel justified in going to the expense of three or four thousand dollars in laying conduits. Wires have already been removed from 125 streets and placed in lanes or underground. The reply of the telephone committee of the city is a request that the city attorney apply to the Railway Commission to force the company to lay all wires underground.

The latest report of the Manitoba Government Telephone System which covered the first ten months of 1912 shows a total revenue of $1,212,461 as against an expenditure of $909,181 leaving a balance of $303,280. The number of exchange stations in operation on November 1st was 24,038, rural stations 9,311, private branch exchanges 3,108, extensions 2,926.

Electrical Development at the Pacific Coast

New B. C. E. R. Terminal

The B. C. Electric Railway Company has recently arranged with the city for the construction of a new Vancouver terminal for its Lulu Island interurban railway. This line extends from Vancouver through Point Grey to Eburne, from which point one division runs across Lulu Island to Steveston and another extends along the North Arm of the Fraser to New Westminster. Along this route settlement has been very rapid of recent years and a large commuter's traffic is carried on over the division. The line now enters Vancouver by a bridge spanning False Creek, terminating at a station at the water level. This location is inconvenient inasmuch as the station is located on low ground and passengers transferring to city lines must either walk up a steep hill or climb a special stairway to the level of the Granville street bridge, over which all the connecting city lines, except one, run.

The new arrangement proposed by the company is the location of an interurban terminal at the south end of Granville street bridge. By this plan interurban passenger cars will not be obliged to cross the False Creek bridge and they will be brought into the station directly on a level with the Vancouver city cars. The terminal will also be of advantage to the city system as it is located near 4th and Granville streets, an important city transfer point.

The depot will consist of two wings, each about 40 by 28 feet in size, connected by a covered passage way 25 feet in width, ample to accommodate the traffic from the interurban lines to the city system. In the south wing will be located the ticket office, agents office, etc., while in the opposite wing will be a general waiting room and separate ladies room. The terminal, being located on made ground, will be of wood construction. The plans call for a handsome structure which will cost between $30,000 and $40,000. The trackage arrangements provide a terminus for the Lulu Island cars on the west side of the station. The east frontage of the station is located directly on the Granville street bridge, all the Fairview cars of the company passing this point on their way to the business centre of the city.

Change in Route

The route of the Westminster interurban line of the B. C. Electric Railway Company, the original line connecting New Westminster with Vancouver and which started operation in 1891, was altered during the early part of this month through the completion of the Highland Park cut-off. The old line entered New Westminster along 12th street along which thoroughfare there was a very steep grade rendering extreme care necessary in the operation of heavy interurban passenger coaches or freight trains such as are used on this branch of the B. C. Electric system. The Highland Park cut-off leaves the old interurban line at Highland Park and proceeds by a winding route, taken for the sake of easier grades, into New Westminster. The running time between Vancouver and New Westminster has been lessened by ten minutes because of the change of route and the service is now operated on safer lines. With the Highland Park cut-off in service it will be possible for the company to carry out its plans of operating two car trains between New Westminster and Vancouver. This step is rendered necessary by reason of the rapid growth of the suburban traffic along the line both in the vicinity of Vancouver and New Westminster. The section of the Westminster interurban line which has been abandoned for interurban traffic will not be covered by cars connected with the New Westminster city system. During the month the B. C. Electric has also placed in operation an extension of its line, one-half mile in length, on Lonsdale avenue, North Vancouver. On Vancouver Island an extension of the company's system has also been opened operating along Hillside avenue.

No More Grade Crossings

The provincial authorities of British Columbia recently declared against the policy of the establishment of grade crossings, where these can possibly be avoided. Recently the municipal council of South Vancouver decided to establish a grade crossing at Rupert street, where the road crosses the Westminster interurban line of the B. C. Electric. A subway now exists at the point but it was claimed that this was too low for ordinary traffic. The management of the B. C. Electric entered a protest on the plans of the municipality and ratepayers holding property in the vicinity also entered objections. The question was argued before the Hon. Thomas Taylor, Minister of Railways for the province at Victoria. After hearing both sides, the Hon. Thomas Taylor stated that under no circumstances would he favor the establishment of a grade crossing at the point. The policy of all growing communities was to avoid grade crossings wherever possible and the idea of the South Vancouver authorities in substituting a level crossing for a subway at Rupert street would be a distinct retrograde movement. A few days after the argument the Minister of Railways announced his decision to the effect that the grade of the railway should be raised two feet at the road crossing, thus making possible a subway which would meet the conditions of the case.

For Motormen and Conductors

The management of the B. C. Electric Railway Company is providing for the comfort and convenience of the motormen and conductors employed on its Vancouver lines by the construction of a five storey club building at the corner of Main and Prior streets, Vancouver, this location being directly opposite the principal car barns of the company in the city. The building will have a frontage of 25 feet on Main street and a depth of 60 feet on Prior street. The Prior street frontage to the rear of the block is owned by the company and in the plans of the building arrangement is being made for the extension of the block should the need arise. On the first floor of the block will be located the general waiting room for the men and offices for the depot masters and inspectors. On the second floor will be a large billiard room which will be furnished with billiard and pool tables. On the third floor will be located the reading room and about one-half the floor space of this flat will be used for lockers. The fourth floor will be devoted entirely for lockers, this accommodation in connection with the third floor providing lockers for over 500 men. The gymnasium will be located on the fifth floor, the entire flat being left free of obstruction as far as possible. In this room will be installed a complete set of gymnasium apparatus. The upper floors of the building will be reached by an elevator as well as a winding stairway . Lavatory accommodations are provided on each floor. In preparing the plans, the company's architect has studied the plans of similar buildings operated by electric railways on the continent for their men and is arranging for a building adapted to local needs and conditions and up to date in every particular. The block will be of brick construction, the frontage being trimmed with terra cotta. The estimated cost is between $30,000 and $40,000.

Will Raise Voltage

The B. C. Electric Railway Company is contemplating the alteration of its transmission system on the lower mainland of B. C. and the provision of an improved central service covering its large territory in that section. At present the company's transmission lines, carrying 40,000 volts, run from the generating station on the North Arm of Burrard Inlet to sub-stations at Burnaby and Vancouver, at which points the current is stepped down and distributed. The company's new plans as tentatively announced contemplate the erection of a large receiving station near Esmond avenue, Burnaby, along the route of the Burnaby interurban line. Current will be sent to this station from the North Arm power house at 60,000 volts and connections established from the central point with the various sub-stations, a loop system being formed so that alternate sources of power will be available at each point in case of accident to any part of the lines. The plant of the company, while not complete as to detail, are said to involve the reconstruction of the present pole lines from Lake Buntzen, equipping the line with 60 foot poles carrying metal cross arms and disc insulators of the suspended type.

B. C. Water Powers

Mr. G. Gray Donald, of the Provincial Water Branch, recently completed an estimate of the water powers on the Columbia, Pend d'Oreille, and Kootenay Rivers in B. C. Investigation shows that the amount of available water power in the districts visited will approximate ten times what had previously been supposed, and there is every reason to believe that the same proportion will apply in other sections of the province. The estimates made this year while not supposed to be absolutely accurate, are sufficiently near for all practical purposes. They are such that any one desiring to lease a water power will be able to ascertain by consulting the department records whether the powers available will be sufficient for contemplated purposes, together with all other necessary incidental data. Mr. Gray Donald states that a similar estimate is to be made of all the water powers in British Columbia.

Victoria, B. C. Street Lighting

The city of Victoria, B.C., is now consuming practically double the amount of power for street lighting purposes that was used a year ago. This is due largely to the steady increase in the street electrical illumination scheme by the extension of the cluster lighting system in the down town section, and of the arc lighting in the outlying districts. The total cost for the year will be in the neighborhood of $16,000. With the recent installation of new apparatus and machinery at the electric lighting station, the capacity of the arc lighting system has been greatly increased. So far this year about 160 lights have been installed, another 100 will be put in immediately, the re-arrangements of the circuit being completed.

Miscellaneous

The Pacific Great Eastern Development Company, a corporation controlled by the Pacific Coast Eastern Railway, Vancouver, has applied to the B. C. Government for a license to use from the Cheakamus River for power purposes 2,000 cubic feet of water per second. The Cheakamus River is a tributary of the Squamish River emptying into Howe Sound some 30 miles north of Vancouver. The water will be diverted at a point two miles below North Creek fork. It is understood that the power will be used for lighting the streets and dwellings and for industrial purposes at Newport, which was recently acquired by the Pacific Great Eastern Co. from the Howe Sound & Northern Development Company.

The municipality of Esquimalt, Victoria, B.C., has awarded the contract for street lighting to the B. C. Electric Railway Company. The installation is a series tungsten system consisting of apparatus having a capacity of 275 80-watt lamps, of which 130 will be installed immediately and the balance from time to time as required. Current will also be supplied by the company. Messrs. Taylor & Gonnason, consulting engineers, Victoria, were called in by the Esquimalt municipality in an advisory capacity to report on the merits of the various tenders submitted.

Application is being made for extensive water rights on Brandt Creek, Indian River and Norton Lake by the New Westminster Power Company, Ltd., a concern backed by local and British capitalists. The plans of the company cover the erection of a 500 acre feet reservoir at Young Lake, one with a capacity of 10,000 acre feet at Norton Lake, a third on Indian River to hold 2,500 acre feet, and a fourth to control 10 cubic feet per second on Brandt Creek.

The Pacific Coast Eastern Development Co. is applying for a license to use 2,000 cubic feet of water per second from the Cheakamus river, a tributary of the Squamish in the Howe Sound district. The water is to be diverted at a point two miles below North Creek Forks. It is understood the power will be used electrically to furnish light and power at Newport.

The Nanaimo Electric Light, Power and Heating Co. will apply for a license to take 150 feet per second, in addition to their present record, out of Mill Stone river. The water will be used for generating electric light, power and heat in the city of Nanaimo and within a radius of fifteen miles.

The B.C.E.R. Company, Vancouver, have recently placed an order for 3 HB. Westinghouse control equipments. These are to be installed on three Dick-Kerr locomotives now being operated by this railway company.

The Vancouver Island Hydro-electric and Tramway Co., Ltd., has been incorporated with a capital of $500,000 with head office at Victoria, B.C. The usual licenses were applied for.

The Telkwa Light & Power Company, Ltd., has been incorporated with a capital of $500,000 to carry on the light and power business in all its branches with head office at Victoria, B.C.

The Cariboo Power Co. has been granted a certificate of incorporation. Head office Victoria.

The Westminster Power Co. has been incorporated with the usual powers. Head office Victoria.

1264. Electrical goods.—An engineer at Manchester is open to act as buying agent for Canadian importers of electrical goods.

Montreal and the Province of Quebec

Transmission Line Design

At the last meeting of the electrical section of the Canadian Society of Civil Engineers, Mr. Julian C. Smith, chief engineer to the Shawinigan Water & Power Co., read a paper on "Transmission Line Design." This paper covered a wide range and dealt with many features in connection with the electrical and mechanical design of power lines. Several interesting and important points were brought out, among them being various methods of computing the electrical characteristics of the lines, and some indications as to the limits which exist in ordinary practice as regards voltage and regulation. In the discussion of the mechanical design, an argument was advanced showing how the most economical span could be determined, and various curves were shown on this subject.

Information of considerable value was presented by Mr. Smith in this paper, particularly dealing with the actual cost of the construction of transmission lines, and with figures as to the cost and distribution among the various components which go to make up the complete line. A discussion followed the paper and additional data was presented on the subject of testing steel towers by Mr. Kaelin, the assistant chief engineer of the Shawinigan Company; on formulae for determining sag in transmission lines by W. D. Bergman, tower line engineer; also operating data on the Shawinigan line by Mr. John Morse, operating superintendent. These three discussions formed a part of the main paper of the evening, and taken as a whole the paper, with discussions, was designed to illustrate the general subject, the design and operation of the new line from Shawinigan Falls to Montreal being considered typical.

Several points in the papers were dealt with by other speakers. Mr. K. B. Thornton, of the Canadian Light and Power Company, gave details of trouble on their transmission line, and pointed out that the public needed education on the dangers of interfering with the lines. He also remarked that more attention was now being given to transmission lines in building a plant. Mr. R. M. Wilson, of the Montreal Light, Heat & Power Company, spoke in favor of sectionalizing switches, as they enabled trouble to be so easily located and quickly repaired. He believed that with care lines of 30,000 voltages could be carried through streets. Mr. R. S. Kelsch stated that the paper was the most complete he had ever heard, covering as it did the entire subject of transmission lines. Mr. Kelsch expressed a preference for concrete over steel anchors. Mr. Gaspe de Beaubien also spoke, and Mr. Smith replied to the points raised.

Quebec's Water Powers

A report has been submitted to the Quebec Legislature by a commission appointed to make a study of the water powers of the province. Among the recommendations is the regulation of the flow of water in the St. Maurice River by the construction of a dam which would control the flow and give a much more even supply all the year round. The report states that records covering a period of twelve years at Shawinigan show that the flow fluctuates between six thousand and two hundred thousand cubic feet a second, according to the seasons. The regulation of the flow would therefore produce a considerable effect. The three dams existing on the Manouna tributary of the St. Maurice are not regarded as being sufficient. The project recommended by the commission is the damming of the St. Maurice itself at La Loutre (Otter) rapids. According to the calculations made, the damming would provide an even supply of 18,000 cubic feet per second throughout the year, at Grand'Mere, Shawinigan and La Tuquette. The cost of executing these works is estimated at $1,300,000, and the commission is of opinion that the expenditure would be justified. A series of figures showing what the increased revenue would amount to are given.

Municipalities Must Consent

The Bill of the National Hydro-Electric Company has been considerably modified by the Private Bills Committee of the Quebec Legislature. The company expect to be in a position to have 40,000 horse power by next September and 160,000 horse power in two and a half years' time. At the suggestion of the company's counsel, over one-half of the counties proposed to be exploited were dropped out of the bill; these are Montcalm, Joliette, Berthier, Richelieu, Vercheres, Laprairie, Napierville, St. Johns, Iberville, Missisquoi, Chambly, Chateauguay and Beauharnois. The counties remaining in the bill are Assomption, Terrebonne, Two Mountains, Jacques Cartier, Laval, Argenteuil, Soulanges, Labelle and Ottawa. The reason for this narrowing of operations is that the company are of opinion that they cannot do business over such a wide area as was at first proposed.

The big fight in committee was over the question of the approval of municipalities being obtained before the company can do business within their limits, and it was decided that this consent must be secured; in the event of a refusal, an appeal can be made to the Public Utilities Commission. This consent was strongly opposed by the company, on the ground that it would involve great delay.

Electric Reminiscences

Mr. W. D. Shaw of the Montreal Electric Co. gave some reminiscences of the early days in the Montreal electrical business at the weekly luncheon of the Electrical Association of the Province of Quebec, Montreal. He spoke of the time when the first telephone was installed in Montreal, and of Mr. F. H. Badger, Sr., selling the models and rights, received from Mr. Edison, for $100. This was without a transmitter. Mr. Shaw was employed at one time by Mr. P. W. Ness, who ran a wire to the Gazette office, from where a number of customers were supplied with power. The operations of the Royal Electric Company were referred to at length, including the company's participation in the street railway project. The names of many men who are now well known in the electrical world were mentioned as having been connected with this company, and it was also stated that the first electric light dynamo used in Canada was brought into Montreal. Mr. Fred Thomson, Mr. J. Bennett, Mr. Camp, and Mr. E. W. Sayer also spoke of incidents in the earlier days.

An important amendment has been made to the Bill of the Montreal Council, before the Quebec Legislature, asking for authority to contribute $2,000,000 towards the expense of the G. T. R. in removing level crossings and replacing them with elevated or underground tracks. It was decided by the Private Bills Committee of the Legislature that Montreal be allowed to contribute only on condition the tracks be sunk or placed underground and that the trains be operated by electricity.

Mr. Jas. Bennett Resigns

Mr. James Bennett, superintendent of the electrical department of the Canadian Fire Underwriters' Association, Montreal, has resigned, having been appointed managing director of the Fire Prevention Company of Canada, Limited, which controls an electric automatic fire alarm system and fire preventive and protective appliance. Mr. Bennett, who is the first to occupy the position of electrical superintendent for the underwriters, at the outset encountered considerable opposition in his endeavors to improve electrical wiring conditions. By means of diplomacy, however, the objections of the contractors were gradually overcome, although even now the demands of the underwriters are sometimes considered to be excessive. The situation to-day, from the wiring point of view, has improved in a very marked degree, due to the work of Mr. Bennett and his staff of inspectors. He is the only Canadian member of the Electrical Commission of the National Fire Protection Association of the United States and Canada, and is also connected with electrical inspection associations in the United States. Mr. Bennett's resignation will become effective from the beginning of April.

Westmount Again Reduces Rates

The Electric Lighting Department of the city of Westmount, P.Q., had a very successful financial year, and it has been decided to again reduce the price of the current for private lighting. In 1909 the price was 10 cents per kilowatt hour, and by a series of gradual reductions it has been brought down to 6 cents, which is the rate for the new year, under five year contracts. Besides this, the price of street lighting, which in 1909 was $73, will be $55. In addition to a depreciation fund of nearly $100,000, there is a sum of $28,000 to the credit of profit and loss. Orders have been given for an addition of 50 magnetite arc lamps supplied by the General Electric Company, and it is proposed to erect a further 100 lamps in the spring. Following on the announcement of the reduction in price to 6 cents, the Montreal Light, Heat and Power Company, which also supplies Westmount with current, have decided to give their customers a similar reduction.

The "Journal"

The Montreal Electrical Society have issued the first number of their monthly "Journal." It is a very creditable production, well arranged and printed. Its publication is evidence that this society is very much alive, though it is less than a year since the society was formed. The contents of the "Journal" naturally deal with the doings of the members, outlining the history of the institution and showing the progress being made. Two meetings are held every month during the season—on the first Friday at the Y.M.C.A., Drummond street, when lectures are given, and on the third Thursday, at the Edinburgh Cafe, St. Catherine street west, when informal discussions on electrical subjects take place. The latter meetings are designed to be of a social character. At one of the meetings Mr. P. T. Davies, the president, gave a short lecture on "Resuscitation from electric shock."

Pumps for Ottawa

Heap and Partners, Limited, Montreal, are supplying the city of Ottawa with two Rees Roturbo centrifugal pumps in connection with the waterworks system. The pumps have a capacity of 3 million gallons each, and are to be electrically driven. The motors have been supplied by Bruce, Peebles & Company, Limited, Edinburgh, through Roper, Clarke & Co., Limited, Montreal, the eastern representatives. The two motors are of the 160 B.h.p. 2 phase, 60 cycle, 2100 v. 1200 r.p.m., synchronous speed, wire wound induction type, complete with drum type controller and resistance. The efficiency of the motors at full load is to be at least 93 per cent. and at half load 90 per cent.; the power factor at full load is to be at least 90 per cent. The same firm are supplying the switchboard and auxiliary equipment.

St. Catharine Street Lighting

Provision has been made by the Electrical Service Commission, Montreal, for placing 3½ inch ducts for lighting purposes when the underground conduits on St. Catherine street are constructed. It is proposed to replace 57 arc lamps with 142 ornamental standards, and the Electrical Commission have made the necessary alterations in their plans so as to give the required service connections. The lamps will be placed alternately on either side of St. Catherine street throughout the distance that will be served by the new conduits, and they will be arranged in such a way that not only will there be a lamp standard at every street intersection, but one between the street corners as well. At the principal street corners there will be two lamp standards.

Twelve Units for "The Cedars"

The Cedars Rapids Manufacturing & Power Company have ordered twelve units of water-wheels aggregating 120.-000 h.p. Nine units of 10,000 h.p. each will be built by the I. P. Morris Company, of Philadelphia, who will also supply the exciters, governors, pumps and auxiliary equipment. The remaining three 10,000 h.p. units will be built by the Wellman, Seaver & Morgan Company, of Cleveland, Ohio.

Miscellaneous

The bill of the Saraguay Electric and Water Company has passed the Private Bills Committee of the Quebec Legislature. A clause extending the powers of the company to allow the sale of gas was withdrawn owing to strong opposition. The company, by the bill, changes its name to the Montreal Public Service Corporation, which will also include the properties of the Canadian Light & Power Company, The Dominion Light, Heat & Power Company, and the St. Paul Electric Company.

The Laurentide Pulp & Paper Company have recently purchased a water power on the St. Maurice River capable of developing 25,000 h.p. With the addition of this new power, the company now has an available development of 70,000 h.p. Work has been started on the water power adjacent to the company's plant, and it is expected that the company will in the future go extensively into the power field.

In a Bill of the city of Quebec before the Provincial Legislature a provision has been inserted with the object of abolishing unnecessary telegraph, telephone and electric light poles. The city engineer will decide what poles are not needed, but his decision is subject to appeal to the Public Utilities Commission. Should the decision be against a company, the latter is liable to a fine of $5 per day for each pole until the latter is removed.

Most of the large contractors and supply houses of Montreal have signed a petition to the city council asking that the Tramways Company be allowed to carry building material through the streets of the city. It is urged that this will reduce the cost of haulage, facilitate building operations, and lessen the cost of buildings.

The annual dinner of the Electrical Association of the Province of Quebec will be held on January 16, at Cooper's Restaurant, Montreal.

New Developments, Improved Designs, 1912

A Brief Review of the Trend During the Past Twelve Months in the Different Phases of Modern Electric Practice

Railway Development

There have been a number of developments in the railway field during the past twelve months that have contributed very greatly to the high state of perfection which electric railway engineering has reached. These developments indicate that more attention has been paid to the economic side of railway operation, such as improvements in car and locomotive equipments; generating and converting apparatus. Among these improvements may be mentioned the following:—

The use of high voltage direct current for traction systems; thus retaining the advantages of the d.c. series motor, which have been found so satisfactory on low voltage work. This system is frequently used where alternating current is available and it is not feasible to distribute high voltage in the towns served by the road. The high voltage direct current system can be installed as an addition to an existing 600 volt system, which is a decided advantage for interurban lines. A 1500 volt d.c. equipment can be used over the interurban section, and also over the 600 volt city tracks, on which latter the smaller cars can continue to operate. Supplying this high voltage direct current has called for a corresponding development in generating equipment, which has reached an unusually high degree of perfection. The current is furnished by either motor-generator sets or rotary converters, two direct current armatures being connected in series to deliver 1200 or 1500 volts.

The switching equipment follows the same lines as for the 600 volt equipment, with the addition of precautionary measures, such as heavier insulation, longer breaking distances, and removal of live parts from the operation. The breakers are mounted higher than the lower voltage type, and are generally operated by a rod similar to oil switches. The motors for this service have reached a high standard of development. The armatures are specially designed to withstand the higher voltage; having liberal creepage distances at each end of the commutator. The brush rings have extra heavy porcelain insulators, and the clearances from live parts are greater than in the 600 volt motor. The bearings are dust-proof, and the motor is entirely enclosed.

Electric locomotives continue to gain favor, and a number of roads already using them have increased their equipment, and several other roads have bought their initial equipments during the year.

Several cities have adopted radical departures in car construction, embodying some novel features, tending to reduce weight, and to facilitate rapid handling of passengers. These include the stepless car in New York, the "Near side" car in Philadelphia, the centre entrance car in Brooklyn, and the light weight car in Pittsburgh. Probably the most noticeable advance in railway motor design is the "light weight" motor for the Pittsburgh Railways Company, which was built by the Westinghouse Company for use on a car with 24-inch wheels. This design is the outcome of the tendency towards light-weight city cars, and the adoption of the 24-inch wheels by the Pittsburgh Railways Company. This is the lightest weight per seated passenger, double truck motor car ever built. The motor is humorously designated as the "Dachshund," since its long, drawn-out appearance reminds one of the canine of that breed. This attenuated feature is necessary in order to obtain space for material required for the desired capacity in the restricted space of 24 inches.

An increasing number of roads have adopted the use of the unit switch control, not only on multiple trains, but also on single cars.

One of the most important recent developments is the use of a new field control. This is effected by having a greater number of field turns on the motors, and by arranging the control so that a portion of the winding is cut out of the circuit. This results in saving in power consumption and flexibility of equipment, the same equipment being adaptable for use on city or interurban service. When a portion of the field winding is cut out, the characteristics of the motor are modified just as if the gear ratio had been instantaneously changed. When connected in this manner, the motor attains a higher speed than with the full field winding in use, and while the normal field is not so well adapted for starting the car, it is much better adapted for producing a high maximum car speed. In this way, a given equipment can be made to operate more nearly under ideal conditions, both in starting and free running, than if it must be arranged on some compromise basis.

Portable sub-stations are being more extensively used this year; a number of roads having adopted them. The uses to which they may be put are:—(a) as spare equipment; (b) to assist in locating the most advantageous point for a permanent station; (c) to assist at times of unusually heavy load.

Commutating poles as applied to rotary converters fulfil the same functions and result in the same advantages as when applied to generators and motors. This last year has seen a number of this type of rotary built, some of very large capacity, including one of 7500 kw., with a momentary capacity of 10,000 kw. A particular feature of this rotary is that it occupies but slightly more space than that of the 1500 kw. converters which it replaced.

Switchboards

One of the most interesting developments during the past year has been the economies in space effected by the use of 7-in. meters, permitting the manufacture of switchboards which have twenty-five per cent. less length than similar boards manufactured heretofore. This has been accomplished without any sacrifice in readability of meters. Boards equipped with the new 7-in. meters are, in general, of considerably neater appearance than those formerly equipped with the standard 9-inch meters.

Further development has been the application of black dials with white markings and white pointers to switchboard meters for use in locations which are poorly illuminated and which depend largely upon artificial illumination. Such black dial meters offer very little reflection and practically eliminate all glare from the face of switchboard, thereby considerably increasing the readability and ease of operation.

Desk control boards are being ordered in larger proportion than heretofore, as the advantages of this neat and compact method of control are beginning to be appreciated. Black marine finish for switchboards has practically become standard.

Oil circuit breakers and carbon circuit breakers have been re-designed and the use of laminated studs for circuit breakers and switchboard work has very greatly increased. They permit direct connection of these devices to the busbars, are in general much more desirable for heavy capacity circuits, and form an unusually neat construction which is very pleasing in appearance.

Transformers

Increasing demand for power for all purposes is leading more and more to large generating stations. Water powers more distant from available markets have been developed, and, as longer distances are involved, higher transmission voltages than ever before have been and are being considered. Plants and transformers are now constructed for 150,000 volt transmissions. The efficiencies of transforming apparatus and the reduced cost of operation of large stations tends toward the concentration of generating apparatus in central points and the elimination of the isolated plant. In the tying together of towns by transmission lines, a network has resulted from which are served many communities which it had not hitherto been possible to serve. One of the most striking developments of the past year has been the installation of small capacity units along transmission lines. The outdoor transformer and switching equipment are contributing in a great measure to the development of small community or farm loads, which are readily appreciated by the transmission companies. There has been a large number of transformer installations by which one transmission company could supply power to another company in case of interruption to the service of either.

The development of the oil insulated, self-cooled transformer for very large sizes has also been a factor in the general development work of transmission. Transformers of the self-cooling type are now made in sizes as large as it is possible to transport by the railroads. The elimination of attendance, auxiliary piping, and the cost of water has made many an installation feasible which otherwise, on account of the cost of operation, would not have been commercially practicable.

One interesting development, or phase of the development, is the acknowledgment by foreign transmission companies of the superiority of transformers of American manufacture. An investigation of the export business shows that American made transformers are being used for most of the high voltage work in foreign countries. Transformers of American manufacture stand pre-eminently first in quality, workmanship and satisfactory operation, and it is a source of great satisfaction to realize that this is being appreciated by foreign engineers.

Carbon Circuit Breakers

A new type of small and moderate capacity carbon circuit breaker has been developed, which is a modification of a type used some years ago. It is made mainly from punchings, is quite rugged in design, and is held in the closed position by the ordinary trigger arrangement. It is made for alternating current or direct current, one, two or three pole, up to 300 amperes and 600 volts.

The large capacity (2,000 to 14,000 amperes) carbon circuit breaker, placed on the market by the Westinghouse Company about two years ago, has been entirely re-designed during the past year to cover capacities of from 1,000 to 20,000 amperes. In the re-designing, the carbon arcing contacts have been coppercoated, providing a constant low resistance connection between the carbons and shunts. The secondary contact has been changed in design so as to provide a stationary contact at such an angle to the moving contact that there is not the same tendency to buckle the moving contact inclosing the breaker after the contact surfaces become roughened by arcing.

The a.c. forms of this breaker have been perfected with spacing between brushes so as to provide for better ventilation, and laminated studs have been provided so as to prevent heating on alternating current. All breakers have been given an exact a.c. rating, and are now listed with the various ratings applicable to direct current, and the different frequencies of alternating current.

Oil Circuit Breakers

The development during the previous year tended largely towards increase in capacities, and this has been carried still further during the past year, so that now practically all of the larger types of oil circuit breakers are of the modified design, and involve the following features:—brush contacts with butt type arcing tips; tanks are lap-welded and are larger, giving greater oil capacity and more air space above the oil. Above the tanks in some of the larger types is a cast bronze gas expansion chamber, with a baffled vent for the escape of gases. The tanks are supported, in addition to the ordinary clamps, by steel rods from the cast base to a steel plate under the tanks, thus preventing any possibility of the tanks being blown off by an extra violent short circuit. The mechanism of the breakers has been improved so as to provide quick action, with dash pots to take care of both opening and closing shocks. With these improvements the instantaneous direct connected breaking capacity has been greatly increased in the different types.

A new breaker of the same characteristics as one of the well-known masonry types (E) has been brought out for mounting on the wall or pipe framework. It requires no cell structure, and because of this omission has a larger breaking capacity than the corresponding size for masonry-mounted breakers.

The type GA (44,000-110,000 v.) breaker, having a separate tank for each pole, previously limited to 300 amperes capacity, has been increased to 600 amperes; and a modification of this type has been developed for use on from 11,000 to 44,000 volt circuits, and possessing a lower breaking capacity. They have porcelain bushings instead of the condenser terminals, and are supplied for outdoor mounting.

A newly developed line of circuit breakers, known as the "Reactance" type, has been supplied in some forms, and designs are available for application of the reactance principle to other breakers. With the double break and a reactance inserted in the second or final break, the ultimate breaking capacity is unlimited.

Industrial Motors

Considerable development has taken place in the application of a.c. slip-ring, phase-wound induction motors for the operation of large electric shovels. Sixty-ton shovels so equipped are now in operation in the Northwest, and one equipped with 25-cycle motors is now under construction for use in an ore mine in Sweden. In connection with machine tool application, the most prominent advances have been made in the reversing planer motor and controller. Another interesting development is the application of electric motors to logging donkeys. The development of self-starting synchronous motor for direct connection to air compressors, while not really a new development in 1912, has now been perfected and is practicable for all commercial purposes. A greater number of these outfits were installed in 1912 than in all previous years.

Commutating Pole, Direct Current Motor

There has been practically a universal endorsement of the commutating pole, d.c. motor, including various classes of industries. Much improvement in the mechanical features, such as frame, bearings and shaft, insulation, type of winding, etc., has been devised, but it is only recently that the commutating pole feature of motor design has reached such a state of perfection, this being due to a fuller understanding of the principles involved.

At the present time, the commutating pole feature is incorporated in motors for machine tool drives and similar applications, and for the more severe classes of intermittent service, such as street railway and steel mill applications, where the work is of widely varying and often reversing nature. In machine shop work, the commutating pole motor is capable of a wide range of speed variation, with heavy overloads, and the intermittently rated motor gives greatly improved commutation through a wide range of load conditions which, as a rule, includes peak load during acceleration, and even higher loads during reversing for such as cranes and general mill service.

The principal advantages afforded by the use of the commutating poles are,—increased reliability, increased life of apparatus, reduced repairs. The improvements mean,—greater continuity of service, less supervision of apparatus, and, in many cases, provision for increased working capacity of machinery. The net result is increased plant efficiency, and there are incidental advantages which will become more definitely established as the user's experience with this design of motor is increased.

Electrically Operated Steel Mills

The have been a large number of new steel mills built during the last several months, and in almost every case electric drive has been considered for the main rolls. In many cases, it has been adopted in preference to steam engine drive. Many of the larger steel companies have existing electric power plants which deliver energy at a cheaper rate than steam can be supplied for an isolated mill engine, the advantages being obtained by the use of gas engines or turbine drive. In the latter case, the plants may include low pressure steam turbines, using exhaust steam from existing mill or power engines or may include turbines using steam from the blast furnace plant where steam can be generated very economically by burning blast furnace gas under the boilers.

The reliability and many mutual advantages of motor drive for steel mills are well established, and it has received the endorsement of many prominent steel mill engineers. The first and practically only question regarding the majority of the applications is "cheap electric power," and as the central stations are doing much to solve this question, it is safe to predict that motor drive will become more universally adopted in steel mills, even for the more severe classes of service, such as reversing mills, etc.

Mining

In the mining field probably the most important advancement as regards the use of electricity has been the remarkable increase in the activity of central stations in supplying of power to coal mines. Not only have existing central stations contracted for vast amounts of power for this purpose, but large companies have been developed almost exclusively for supplying power to coal mining operations. Out of this has grown another development in the application of heavy shaft hoisting in coal mines, as heavy electrical hoists have heretofore been almost exclusively in metal mines, where fuel has been comparatively high in cost. With the central station power, however, the situation is very different in that the mining company does not have to stand the investment of the necessary power house equipment for electric hoists, which in an isolated plant makes the use of heavy electric hoisting almost prohibitive on account of the interest and investment feature and the comparatively small amount of energy consumed in power, giving very poor load factor. Another important development is a greater use of electrically driven air compressors in metal mines, of which a large number have been installed with direct coupled slow speed motors.

In the construction of mine locomotives, the cast bar steel frame bars, during the past year, become very popular, and operators are insisting upon this construction in the heavier locomotives, where the advantages have not been claimed to be so important on account of the greater proportion of weight in the frame itself, which ordinarily gives sufficient strength in cast iron. Notwithstanding the large number of these locomotives installed, there has been no report of failure of these frames in operation. The commutating pole motor has likewise become exceedingly popular, as this feature is particularly beneficial in this service, where the electrical equipment suffers extremely heavy overloads at times, and where the care and inspection given to the equipment are a minimum.

Motor Operated Coal Docks

During the past year several coal dock equipments have been installed, and though steam-operated rigs were estimated on originally, the majority of the plants will be motor operated throughout. Power will be furnished by central stations. As compared with steam drive, the first cost of the dock equipment is less (all power charges being omitted). The operating costs are much less, and the additional load is a decided advantage to the central stations, to the mutual advantage of both. As the amount of power and load factor increases, the cost of power is reduced and a more advantageous rate can be established for the entire community.

Motor Operated Open Hearth Furnace Doors

Motor drive is superseding hydraulic drive in many steel mill applications on account of absence of freezing and other troubles. A practice which is rapidly becoming quite general is the use of motors for lifting the doors of the open hearth furnaces. The mechanical features are simple, and a practical design is to make a separate and complete unit, including motor, control, gearing, etc., for each door.

Watthour Meters

The lower priced, low capacity house-type watthour meter has been extended to capacities up to 25 amperes, and a standardized form of bottom-connected meter has been produced and regularly listed. The gear train has been changed so as to include double reduction in the sub-gear train between main disk shaft and the worm, instead of using single reduction with one large gear wheel. The sub-gear train bearings have been lubricated. A new type d.c. watthour meter has been produced which differs from the previous standard meter in having the armature in the centre, the gear train at the top, and the damping disk at the bottom of the shaft. The meter is similar to others on the market, but differs from them in having spring-supported ball bearings.

Portable Meters

A new induction type ammeter has been placed on the market, which supersedes the older type, having a damping disk running between permanent magnets. The meter is by this means highly damped, and by means of other changes the total weight of the moving element is not increased. The winding has been changed, giving as a result a highly damped, extremely high torque meter, with minimum weight of moving element.

A D'Arsonval type meter has also been brought out to supersede an older type. It has single air gap connection with permanent magnets rigidly mounted before they are magnetized and aged. The magnets need not be disturbed in removing moving element for inspection. Special attention has been paid to ease of inspection and repairs. All parts are mounted on a die casting, which can be easily removed from the box, allowing inspection of all details with minimum amount of handling.

Another type meter has been developed that operates on the dynamometer principle, and will be supplied as voltmeters, wattmeters and power-factor meters. This line of meters will present new features in the following points:—higher torque, and lower weight of moving element than previously obtainable. Special attention has been given to the mounting of parts for greater permanence of calibration and ease of inspection and repairs.

Indicating Meters

The induction type switchboard meters have had the weight of the moving elements decreased by the use of aluminium shafts with steel pivots. Name-plates with white background and black letters have been adopted as standard, thus showing entire length of pointer against a white background. Meters having black dials with white pointers and white figures have been developed and applied on several switchboards.

The automobile type meter has been developed and placed on the market. This is a meter three inches in diameter; made on the double air gap D'Arsonval principle. It is supplied in three forms; ordinary round type for use on either automobile dashboards or on small switchboard panels; flush type mounting for automobile dashboards, and illuminated dial type for automobile dashboards. For illuminated dial type, the illumination is indirect entirely; thus preventing any glare in the eyes. Workmanship and accuracy are of the same high standard as switchboard meters.

A new low-priced graphic meter has been developed. It has a moving iron element similar to the Bristol round chart meter. It is supplied as a voltmeter, and as a 2 or 3-wire ammeter, and for either a.c. or d.c. service. This meter represents a direct advance over the round chart meter in that it has a continuous paper scale long enough for seven days' record at one inch per hour. It has a seven-day clock, and a new type of pen which will carry ink enough for seven days. The meter as shipped is available for either portable or switchboard service.

Turbo, Waterwheel and Engine Generators

Modern practice in power plant construction is constantly advocating changes which lead to lower first cost, higher economies, and greater simplicity of operation. One method of attainment lies in the use of larger capacities in single units. During the past year a number of contracts for hydro-electric stations have been placed, which call for 12,000 to 17,500 kv.a., and even larger generators are in prospect. These are either of the horizontal or vertical types, and a wide range of speed is covered. Improvements due to a wide experience, have been made in mechanical construction, ventilation details and armature construction. A relatively cheaper, more efficient, and more reliable unit has resulted.

In steam practice a similar progress is being made. There have been designed and are building horizontal units of 15,000 and 20,000 kw. for speeds of 1800 and 1500 r.p.m., and even larger high speed units are contemplated. Single turbine generators of 30,000 kw. capacity for a speed of 1500 or 1200 r.p.m. for 25 and 60 cycle service, is a possibility of the near future. Modifications of design have been effected whereby the materials used are not stressed materially harder than in smaller units, which have already demonstrated the success of their designs, and different companies are prepared to offer the high capacity, high speed outfits upon demand. These units are also being wound for voltages as high as 13,200.

(Concluded in Jan. 15 issue.)

Decision in Suspension Insulator Case

This is an appeal by Steinberger, President Electrose Manufacturing Company, from a decision of the Examiners-in-Chief affirming the decision of the Examiner of Interferences awarding priority of invention to Hewlett as to the following issue:

1. A disk strain insulator, comprising suspension members, a mass of insulating material partially enveloping the same, said mass being provided centrally with a disk integral therewith and lying substantially in the general equatorial plane of said mass, and further provided with flanges extending in opposite directions from said equatorial plane.

2. A disk strain insulator, comprising suspension members, a mass of insulating material partially enveloping the same and having a disk portion, said disk portion being provided with annular collars extending in opposite directions and in the general direction of said suspension members.

3. A disk strain insulator, comprising strain members, a body of insulating material partially enveloping the same and having a comparatively large disk, said disk being provided with collars integral therewith and extending in opposite directions.

The invention relates to disk strain-insulators for electric conductors designed to mechanically secure and at the same time electrically insulate two connecting parts. It was desired to construct these insulators so as to prevent creepage of current over the surface thereof, not only in dry weather, but in wet weather as well, and this was accomplished by the construction claimed.

In dry weather the irregularities in the surface of the sides of the disk provide against surface leakage by making additional surface without increasing the diameter of the disk, while in rainy weather the same irregularities collect and dispose of the water and prevent the formation of a film of water on the sides thereof, which film if present would cause a more or less perfect electrical connection between the parts intended to be insulated from each other.

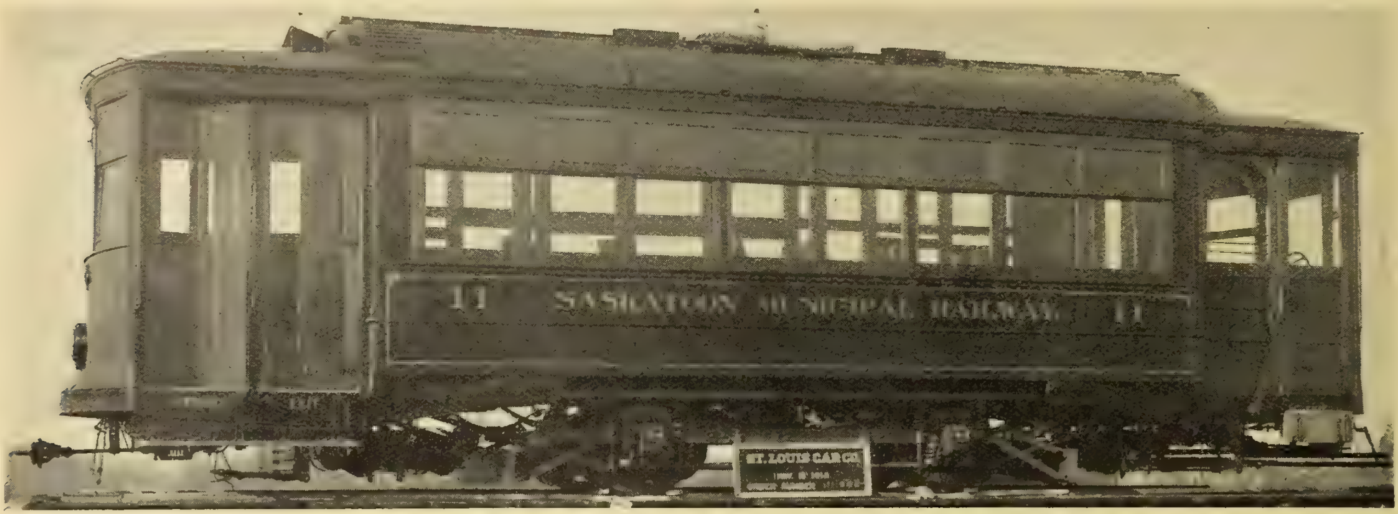
It was shown that Steinberger disclosed his invention by letter to a customer as early as October, 1905, though his patent was not filed until January 20, 1908. The evidence also showed that Hewlett filed his application on April 20, 1907, having obtained the secret of the invention from the afore-mentioned letter. It is held that Steinberger is the original inventor of the issue and the decision of the Examiners-in-Chief is reversed.

Many Happy Returns

We congratulate our contemporary, The Electrical Review, on having just celebrated its fortieth birthday. Forty years ago the field of electricity did not promise a very rich harvest, and the founders of this magazine must have possessed more than the average intuition in foreseeing so many years in advance what the rest of us required another thirty years to recognize. We are pleased to note that the policy of The Electrical Review through all these years has been one of steady development and increased usefulness, and we hope that it may long continue to occupy the high position it has attained among electrical magazines.

The income of the Montreal Light, Heat & Power Company for the six months ending October 31, 1912, showed an increase in net of $171,000.

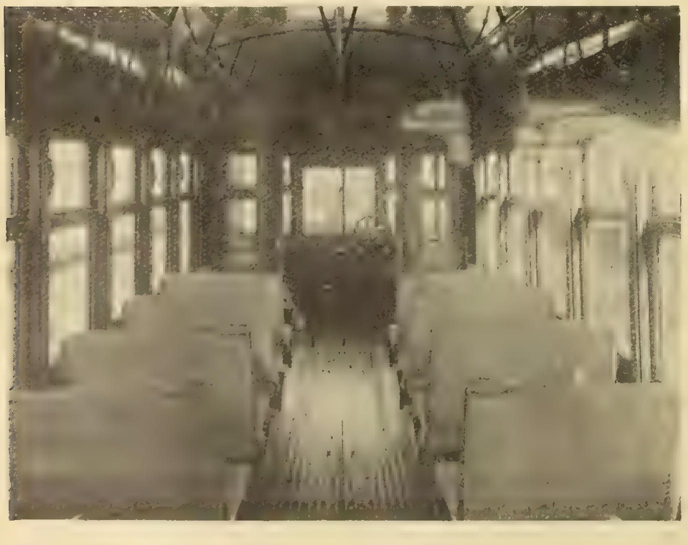
ELECTRIC RAILWAYS



Saskatoon's new street railway equipment—Length over all 34 feet 4 inches.

Saskatoon's Municipal Railway

The accompanying photographs illustrate the new cars recently furnished by the St. Louis Car Company to the city of Saskatoon, for their new railway system. The cars are single truck, double end, straight sided, with drop platform, arched roof, clam shell detachable hood, double sash (top sash stationary, lower arranged to raise) length over body corner posts 21 ft. 4 in., length over all 34 ft. 4 in., length of platforms 6 ft. Bodies are mounted on St. Louis Car Company's No. 72 truck, and are equipped with Consolidated Car Company's buzzer system, International Register Company's type R-5 register, Consolidated Car Company's electric heaters, St. Louis Car Company's ventilators, St. Louis Car Company's foot gong, Hunter destination signs, St. Louis Car Company's sand boxes, H. & B. life guards, Kalamazoo Railway Supply Company's track scrapers, U. S. head-lights, Pantasote curtains, Agasote ceilings, Wilson trolley catchers, twelve cross and four longitudinal rattan seats. The cars were equipped complete with electrical equipment at the St. Louis shops, and shipped ready to enter service.



Saskatoon's new railway equipment.

Contract for 65 Cars

On November 26th the management of the B. C. Electric Railway Co. announced that a contract had been closed with the Preston Car and Coach Co. of Preston, Ontario, for 65 city passenger cars. This is the initial order of the company for 1913 delivery. The cars are to be of single end type and 44 feet in length. The specifications are still subject to minor changes but the cars will be of the latest model throughout. Delivery will be made during the months of April and May.

The company expects to operate its interurban line from Victoria north through the Saanich Peninsula, 22 miles in length, about the first of the year. For this line orders for rolling stock have been placed as follows: 2 baggage and express cars from the Niles Car Company and 6 passenger cars from the St. Louis Car Company. For freight service 15 flats and 25 box cars have been ordered from the Seattle Car Company and two 45 ton locomotives will be taken from the mainland system of the B. C. Electric for use on the new interurban line.

For service on its mainland freight lines the B. C. Electric has recently ordered 25 box cars from the Seattle Car Company and five 50 ton locomotives from the Westinghouse Company of Pittsburg. Other rolling stock recently ordered by the company consists of 2 snow sweepers from the Ottawa Car Company and 6 Hark-Otis steel dump cars.

During the month full delivery has been made of the 24 interurban cars ordered by the company from the St. Louis Car Company last summer and this equipment is now in service. The initial shipments have also been made by the Brill company from its Philadelphia shops on the large order for city passenger cars recently placed with that concern.

In announcing its contract with the Preston Car Company, the management of the B. C. Electric stated that it was not the intention of the company to abandon the car building work in connection with its New Westminster shops. It was stated that the schedule for new rolling stock for all lines of the system for 1913 is now being prepared and in this programme ample work would be allotted to the New Westminster plant. At these shops are now 'being assembled and finished a shipment of 25 steel city passenger cars which have been constantly arriving on an order placed some time ago in the old country.

Morrisburg and Ottawa Electric Railway

Construction on a new electric railway to run from Ottawa to Morrisburg and several other towns and villages in the Ottawa Valley is to commence next March according to statements made by directors of the Morrisburg and Ottawa Electric Railway Company, of which J. G. Kilt, of Ottawa is president. The company is capitalized at $500,000, $150,000 of which has been subscribed and $30,000 paid up, the balance being subject to ten per cent. calls. The main line of the railway is to be from Ottawa to Morrisburg via Ridgmont, South Gloucester, Metcalfe, Norwood, Chesterville, Winchester, Williamsburg to Morrisburg, and will be forty-seven miles long. Subsidiary lines will total in length 50 miles and will run to Russell, Manotick and points in the Rideau Like district.

The route for the main line has been surveyed and the report of the engineers will be submitted to the directors some time this month. Tenders for poles, ties, rails and general equipment for such a road are to be invited almost immediately. As a matter of fact some tenders have already been sent in. Whether electric power will be used or whether gasoline-electric cars will be used is a matter yet to be definitely decided. It is hoped to have part of the road in operation by next August. How many cars and how much material for equipment will be needed is not definitely known at present.

The company have been given permission by the Board of Control to have a by-law submitted to the people in January asking permission to enter the city by some route yet to be determined. The officers of the company are: J. G. Kilt, Ottawa, president; Hector Macdonald, Ottawa, vice-president; James Oliver, Ottawa; R. E. Reardon, Ottawa; R. J. Biggars, Ottawa; J. W. Bogart, Norwood; William C. Strader, Williamsburg; R. A. Bishop, secretary-treasurer. The offices of the company are in the Canada Life Building, Sparks street.

Ottawa Car Company Extensions

The Ottawa Car Company, Limited, are adding a new and up-to-date machine shop to their present plant at Ottawa. This building is 66 ft. by 135 ft., four storeys and basement, and is of solid brick and fireproof construction. The company are now running to their full capacity. They have recently received some very large orders from western cities, including Calgary, for which city they are building twelve p.a.y.e. cars, 46 ft. over all, with Brill 27 G.I. trucks, mounted with steel wheels and equipped with Westinghouse 101 B. motors and air-brakes. The order also includes six trailer cars, 44 ft. over all, centre entrance, p.a.y.e. type, and one standard single-truck double-broom snow sweeper. Calgary has already in operation a number of cars built by the Ottawa Car Company, which are giving excellent satisfaction. This company has also on order for Moose Jaw, six, 21 ft. body, single-truck, and two, 33 ft. body, double-truck p.a.y.e. cars.

Ask Extension of Time

Notice has been given by the Niagara, St. Catharines, and Toronto Railway Co. that they will apply to the Parliament of Canada at its next session for an act extending the time within which the company may construct the following lines: (1) Port Colborne to Fort Erie to the City of Niagara Falls, (2) from the City of Niagara Falls to the town of Niagara to St. Catharines, (3) from the town of Welland to the city of Brantford, (4) an extension of the St. Catharines and Niagara Central Railway Co. to a point on the Niagara River near Fort Erie and an extension to the city of Toronto by way of Hamilton or thereabouts.

Commissioner Upholds W. E. R. Co

An application was recently made to the Public Utility Commission of Manitoba on behalf of the city of Winnipeg for an order requiring the Winnipeg Electric Railway Co. to operate street railway cars on the bridge at Arlington street over the C. P. R. tracks. The application was resisted by the street railway company. The objection was raised by the street railway company that the approaches are so steep as to render street railway traffic dangerous to a degree that would jeopardize the lives of the passengers.

Commissioner Robson based his decision on the reports of two engineers—John Woodman, C.E. of Winnipeg, and R. M. Feustel, C.E. of Madison, and on his personal knowledge of the situation and in the interests of public safety declined to assume the responsibility for granting the order.

London Street Railway Extensions

The London Street Railway Co. are installing an Allis cross-compound, 20 in. x 38 in. x 48 in. Corliss engine and 500 kw. generator and are building an extension to their engine room sufficiently large to accommodate this additional unit. The extra power unit is made necessary by extensions to the road and additions to rolling stock of the London Street Railway Company's system.

Miscellaneous

The Allis-Chalmers Co. of Cleveland, Ohio, have recently closed a contract with the Sandwich, Windsor and Amherstburg Railway Co. for a horizontal, cross-compound, Corliss engine with cylinders 32 and 52 x 42 inch stroke. Operation will be at 100 r.p.m. and the engine will be direct connected to a continuous current generator of 850 kw. capacity for carrying the railway load.

The Niagara, St. Catharines and Toronto Railway Co. have commenced grading work on the St. Catharines to Niagara-on-the-Lake extension. This is a distance of twelve miles. The entire work including the grading, trestles, track laying, etc., is being carried out by the company's own men under Mr. E. F. Seixas, general manager.

A scheme is on foot to connect up the cities of Regina and Moose Jaw by an interurban electric line. A syndicate supposed to have the matter in charge has been represented in Regina by a Mr. Friedman of Seattle who had conferences with the Board of Trade and the city council.

The net profit of the Guelph Radial Railway Co. for the year ending September 30, 1912, amounted to $7,839. After paying a dividend of 4 per cent., sufficient surplus remained to purchase a new electric sweeper for snow cleaning. The assets of the company now amount to $172,478.

Petitions have been circulated and largely signed by North Rosedale and Moore Park residents, asking the Toronto Street Railway Co. to extend its Church street line across Glen bridge, up Glen Road, thence west and south to the bridge again, completing the loop.

Illumination

Artistic and Efficient Fixtures

There is probably no branch of the electrical industry where more noticeable advance has been made in the past few years than in the development of artistic and efficient electric fixtures. These are now so varied in design that it is difficult to give any adequate idea of the beauty of some of these products. Of course, as in other lines, there are different types for different purposes, also hundreds of designs for each of the different types.

The indirect and semi-indirect illumination are very popular to-day, but the old standard of direct illumination will never be done away with, and the probable changes in this style of illumination will be towards more elaborate and more efficient fixtures. One of the most novel features for the direct-type of illumination that has ever been designed, has been placed on the market recently by the Tungstolier Company under the trade name of the T. T. C. Tungstolier. This particular fixture is different, absolutely, from anything that has ever been placed on the market. It has many features which are not only interesting to the electrical trade, but also just as interesting to the builder or consumer.

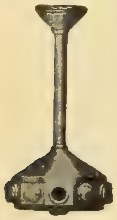


Fig. 1

One will find many stores and offices that to-day may consider their illumination quite satisfactory and perhaps in a year's time they feel that they would like to increase their illumination, but are not in favor of going to the expense of entirely new fixtures. This is one of the features that can be overcome with the use of the T. T. C. Tungstolier.

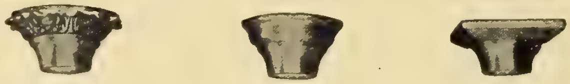


Fig. 2

In Fig. 1 which shows the trunk, it will be noted that around the circumference of the trunk there are a number of buttons which can be unscrewed. In behind each one is the "live contact" ready to receive any of the arms that are shown below. That is, by removing these buttons in the proper place one can make a two, three, four or six light fixture. From this one can readily see that a builder would be in a position to equip all the offices with, for instance, three light fixtures. In the event that some merchant would rent one of these offices and would require more light than usually needed, new fixtures would not be necessary. It would simply mean the purchase of one or two arms and the necessary increase in illumination is obtained.

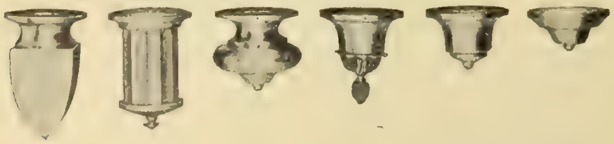


Fig. 3

Fig. 2 shows an assortment of canopies. These cover a round, a square, and a handsome cast canopy. This article is made for both the close ceiling and the stem type T. T. C. Tungstolier. Besides this there are six bottom shells shown in Fig. 3, which can be attached to any of the trunks by merely inserting three screws. There is no iron pipe to thread or to worry about. After you have proceeded and selected the canopy and the bottom shell the next proposition that confronts you is the arms. In the T. T. C. Tungstolier product there are 18 types of arms. As a matter of fact six distinct types and an assortment of three to each type, which consists of an arm without any decoration over the socket, another arm with a very substantial spinning, and another assortment with a heavy massive casting. This arm is put in place into the opening in the circumference by merely shoving same in and locking, and an immediate connection is made. There is absolutely no splicing or soldering of wires.

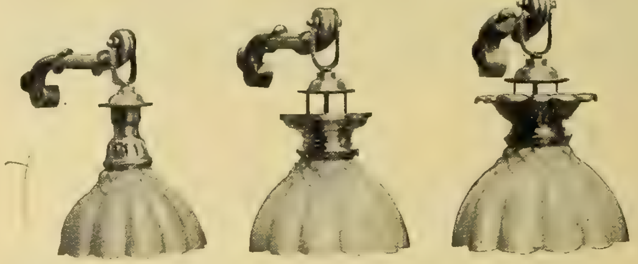


Fig. 4

Referring now to the importance of scientific lighting;—several articles have appeared in the Electrical News from time to time, on the use of the proper lamp and a proper glass and shade holder. As a rule the original installation is properly laid out for the initial equipment, but where the mistake lies is in changes after the first installation. For instance if a fixture is designed for use with 40 watt lamps, and at a later date the consumer would use 60 watts, the reflectors would be inadequate as well as the shade holders, and as a rule it is a mean job to change a shade holder. This has all been overcome in the manu-

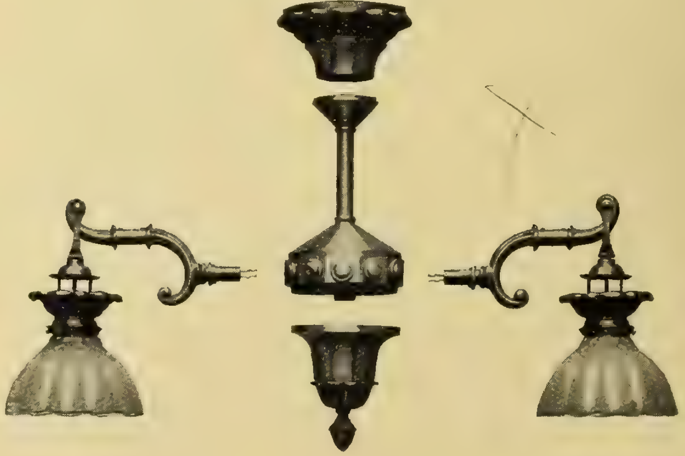


Fig. 5

facture of the T. T. C. arm. By simply a slip up or down the T. T. C. arm is changed to the proper location for either a short base or a long base lamp. It is a splendid feature and a great labor saver. These fixtures have met with great success in the United States. Central stations who have been renting simple fixtures with no elaborations in the past, are now adopting the T. T. C. Tungstoliers for the reason that with a small assortment of trunks and an assortment of arms they have, at their command, any number of fixtures in two, three, four or six lights. In fact, practically any requirement from a massive cast fixture to a neat simple fixture can be obtained with the use of the T. T. C. Tungstoliers. One of the main points in the T. T. C. line is the method by which a dealer can minimize his stock and still have a large assortment of fixtures. For an investment of about $185 very nearly 1944 designs can be made. This is made possible simply by the interchange of the canopies, bottom shells, arms, etc.

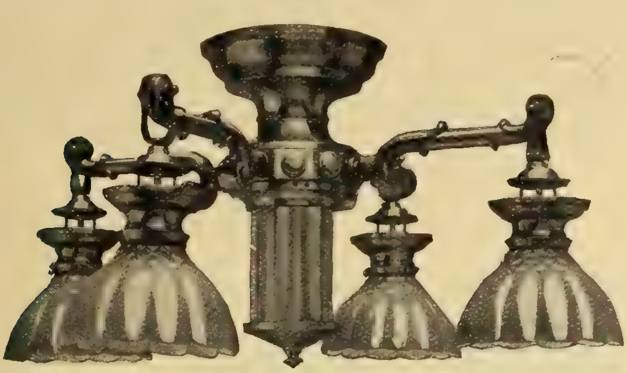


Fig. 6

Show-Case Lighting

It is a matter of surprise to the illuminating engineer the way the average central station man will jump at the opportunity afforded for lighting a few feet of show windows when the showcases in most stores, presenting an area about ten times greater, are allowed to go unlighted and neglected. In a recently completed modern department store of the east there were only 250 feet of show windows to light, while the interior of the store contained an aggregate of nearly 4,000 lineal feet of cases—an opportunity for the sale of almost sixteen times as much current. While it is true the average store does not have 4,000 feet of show cases, it does have a sufficiently large number to make a very inviting proposition.

Probably the current man would hesitate to believe at first reading that only from twenty-five to forty per cent. of the stores of his country use any show case lighting at all. And more, a large proportion of this percentage is most inadequately lighted, so that additional current could be judiciously used in connection with a properly designed reflector system with a noteworthy increase in display efficiency. Ordinarily, four 25-watt lamps will suffice to satisfactorily light each eight lineal feet of case, but a very good rule to follow for the proper show case standard of illumination is approximately double the exterior general illumination. Experience has shown that an intelligent consideration of these two figures will enable any central station solicitor to make recommendations that can be safely relied upon to secure desired results, and assure in many instances much new business in a field which has as yet been only "scratched" on the surface.

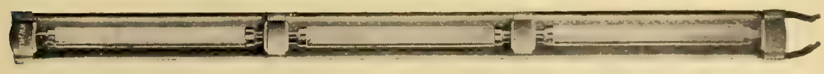


Fig. 1—Type A reflector.

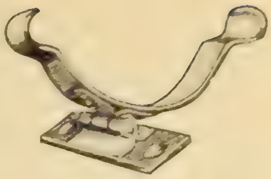
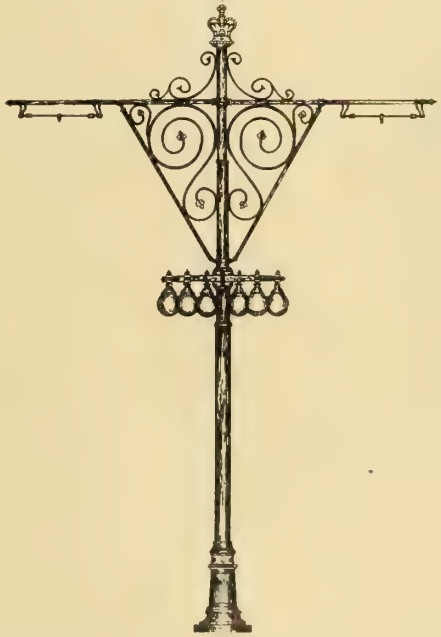


Fig. 2—Hinged clip

One of the most recent methods introduced for lighting show cases is the J-M Linolite system of illumination made by the H. W. Johns-Manville Company, New York, which consists of a tubular electric light nearly a foot long with the filament stretched out straight. These lamps, complete with reflectors, only occupy a space of 1½ inches deep by 2½ inches wide, and can be easily attached to or detached from the case by means of spring clips. These clips are readily adjusted to the interior of the show case, and firmly support the removable shell in its proper position. An ornamental or plain stand pipe or wire conduit is then run down in a corner and through at one end of the case into an outlet box under the base of the case. A single pole flush switch is usually provided for this outlet box so that the lights of each case may be individually controlled when desired.

Plaza Lighting in Ottawa

The Ottawa Electric Railway Co. are to be commended for the care they have taken in installing ornamental posts to harmonize with the general scheme of beauty on the Plaza, the new wide thoroughfare just completed by the Dominion Government in front of the Chateau Laurier. The accompanying illustration indicates the general design of the standard. There are four of these across the Plaza erected on the six foot way between the tracks. The standards are 23 ft. 6 in. from the ground, and the cross arms which support the trolley wires are 14 ft. long and 20 ft. above the tracks. The crown is an Imperial design colored in blue and gold. The posts were designed and erected by the Ottawa Car Company and have come in for much admiration from the citizens of Ottawa and from Canadian legislators at present in session there.



Application is being made by the Moose Jaw Electric Railway Co. for power to extend its lines outside the city of Moose Jaw and to increase its capital from one-half a million dollars to $1,000,000.

Correct "Semi"-Indirect Illumination

Owing to the success of the Indirect lighting appliances that were placed on the market only a few short years ago, many different types of other Indirect, and so-called "Semi"-Indirect types have since then been brought forward. Of these the "Semi"-Indirect lighting fixtures, which are really nothing but modified direct lighting, have perhaps met with most favor. The science of illumination is of such recent development that comparatively few understand its basic principles. While the people at large demand more rational illumination than formerly, the introduction of correct practice has been a campaign of education,—education not only of the masses, but an education of thousands whose business is that of lighting equipment, or lighting in its numerous branches.

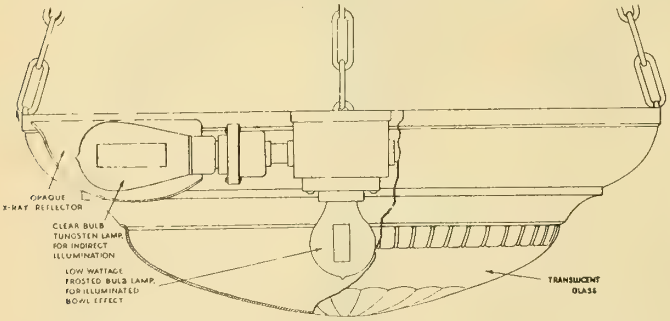
Years of experience in tens of thousands of installations, numerous exhaustive tests by those in the business as well as by many of the largest companies in this country who have adopted Indirect illumination, have proven that the following essentials are necessary for economic and complete success in Indirect lighting:

The most powerful of reflective surfaces.
Scientific design of the reflector.
Permanent efficiency of the reflector.
Low maintenance cost (ease in cleaning).
Correct engineering practice.
Correct ocular practice for greatest eye efficiency.
Variety and harmony in fixture design.

While some of the various types of "Semi"-Indirect lighting fixtures are attractive from a decorative point of view, experience is proving the contention that fixtures of this character, with brilliantly illuminated bowls, are not correct in practice for economical and seeing results. This is proven by the users of same in most instances coming back and installing in combination with them the old objectionable desk lighting. The reasons for this are:

(a) Owing to the absence of control of the light rays, there is a considerable loss of light by absorption on that portion of the interior of the room a considerable distance both ways from the ceiling angle.

(b) There is a loss by the absorption of light by the translucent bowl.


OPAQUE X-RAY REFLECTOR
CLEAR BULB TUNGSTEN LAMP. FOR INDIRECT ILLUMINATION
LOW WATTAGE FROSTED BULB LAMP. FOR ILLUMINATED BOWL EFFECT
TRANSLUCENT GLASS

(c) There is difficulty in cleaning most of the translucent bowls and in restoring them to their original translucency after the dirt becomes ground in by a few cleanings.

(d) The intrinsic brilliancy of the direct lighting source is not reduced sufficiently to enable the eye to work to full capacity.

Now that the knowledge of correct practice in illumination is becoming more widespread, it is calculated that in cases where the consumer desires "to know where the light comes from," or where a translucent effect is desired, there should not be over 6 per cent. to 10 per cent. of the total light generated diffused through the bowl. Engineers now contend that in no instance should this luminosity be of greater intensity than the ceiling.

This translucent bowl effect is very easy to secure by using a small lamp in combination with efficient Indirect lighting equipment, installed underneath the interior equipment in the bowl, to give approximately the luminosity mentioned to that part of the body of the fixture made of translucent material. This has been worked out very satisfactorily in Boston, Toronto, Chicago, St. Louis, and many other cities. The accompanying illustration shows how this is done. Such lighting fixtures lend themselves to a great variety of designs to harmonize with the different classes of interiors.

Winnipeg Street Lighting

Fig. 1 shows the type of street illumination being now largely adopted by Winnipeg. These standards are spaced about 80 feet apart and are equipped with two 6.6 ampere magnetite arc lamps. Fig. 2 shows the method adopted for erecting festoons on the occasion of a recent celebration.

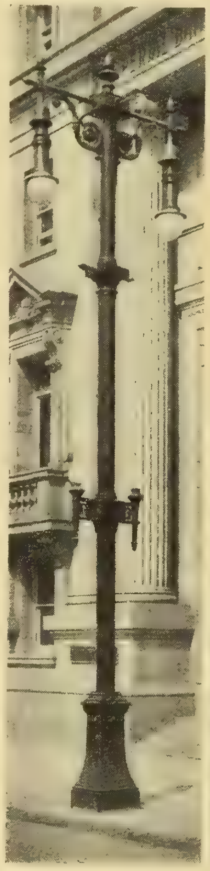


Fig. 1

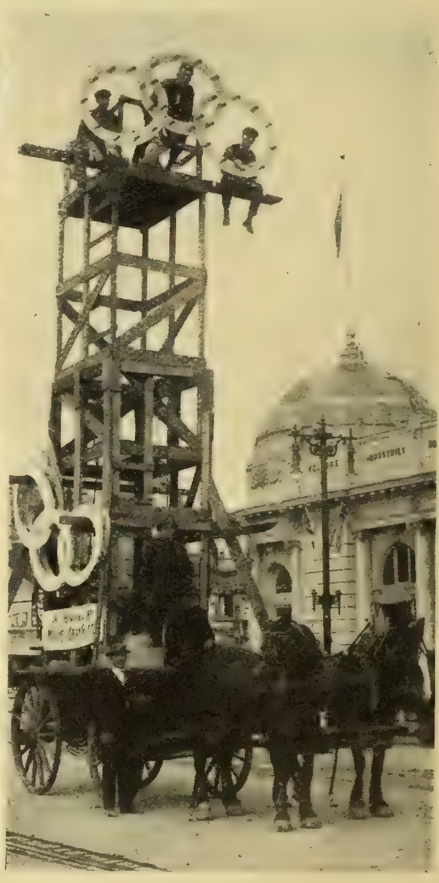


Fig. 2

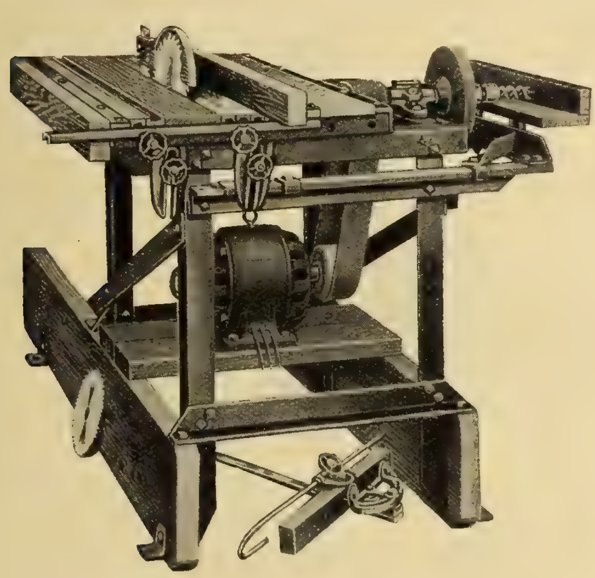
Consulting Gas Engineers

Messrs. Woodmansee, Davidson & Sessions announce that they have associated with them in the capacity of combustion engineer, Mr. C. M. Garland, late of R. D. Wood Company, and formerly of the Faculty of the University of Illinois. Mr. Garland has had extensive experience in theoretical and practical combustion work during the past ten years, and has specialized in the gasification of fuels and the application of producer and water gas to industrial and power requirements. After January 1, 1912, this firm, in addition to their present line of work, will be open for consultation on the design and operation of producer and water gas apparatus, gas power installations, gasification of low grade fuels, and the application of gas to the various heating problems.

The Dealer and Contractor

Motor Driven Circular Saw

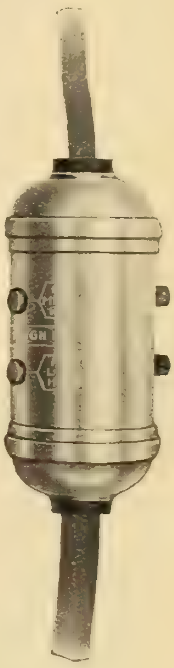
The accompanying illustration shows a remarkably serviceable combination woodworking machine made by the Parks Ball Bearing Machine Company of Cincinnati, Ohio. This machine is driven by a 3-horsepower, 60-cycle, 220-volt alternating-current Westinghouse induction motor. The machine may be used as a circular saw and also as a boring machine by means of an attachment. It is made in two sizes, light and heavy, the former suitable for driving by a three inch belt, and the latter by a four inch belt, the belt in each case running over a 3-inch pulley operating a saw 14 inches in diameter for ripping hard lumber. The frame is made of heavy angle steel, strongly braced, with overlapping corners securely belted together. A long substantial wooden base, one on each side, greatly increases the steadiness of the machine, giving more foundation and distributing the strain over the floor area. Angle steel clips are provided on the timbers for holding the machine to the floor. A saw table is made of angle and channel steel ground to a uniformly level and true surface. The angle steel side table affords a substantial support, on which to bolt wood extensions of any width or length for work. The table is hinged at the back and so as to permit its being lowered or raised. It is provided with an adjustable depth cut having an opening for a 14-inch saw that will cut 5 inches deep. The machine can also be supplied with a boring attachment which can be used for routing, mortising and turning rosettes. This consists of an adjustable sliding support to hold the material being bored and a chuck attached to the end of the saw mandrel. Holes are provided in the frame for this attachment which can easily be added after the saw has been installed.



The machines are designed for electric drive by motors of from 3 to 4 horsepower capacity. The motor is mounted on the floor and belted to the pulley on the shaft which is mounted on the base timbers. The motor shown in the illustration, herewith, is of the alternating current type with what is known as a squirrel cage rotor or revolving part. This type is particularly adapted to use in wood working plants because of the absence of moving contacts and the entire elimination of any danger of fire from sparking. The motor requires absolutely no attendance, beyond an occasional oiling, and may be started and stopped from any point that is convenient to the operator.

Three Heat Cord Switch

There are many electric heating devices now on the market that are designed to operate at several "heats." Such devices as electric water urns, chafing dishes, heating pads, frying pans, table stoves, tailor's irons, etc., are advantageously operated under varying conditions at a low heat, medium heat and high heat. For the convenient control of these devices the Cutler-Hammer Mfg. Co. have augmented their line of feed-through or cord switches by the addition of a three-heat brass shell type as shown in the accompanying illustration and which can be placed on the cord in the most convenient location for operation. There are two push bars each having a light and black button which operate twin mechanisms so arranged that the pushing of one light button alone gives low heat, while the other white button, operated alone, gives medium heat. The shell is plainly marked so that the operator may know which button to press for low and which for medium heat. To get high heat both are pushed. The operation is positive and snappy, and one hand only is needed for the manipulation of the push buttons. As can be seen from the illustration two-conductor cord is required to connect to the socket or receptacle and three conductor cord is needed to connect the switch to the heating device. The brass shell is finished in polished nickel. The rating of this new three-heat switch is 6 amperes at 125 volts or 3 amperes at 250 volts.



The Canadian Union Electric Company, Limited

The Canadian Union Electric Company, Limited, have opened an office in Toronto at 122 Wellington street west, which will be under the personal charge of Mr. Allan B. Wearing, the managing director of this company. They will carry in Toronto a complete stock of motors, arc lamps of all descriptions and other electrical equipment. This firm make a specialty of scientific illumination as applied to factories, stores and large outside areas, using either the direct, indirect or semi-indirect system, as best suited to the conditions. A particular feature of their indirect and semi-indirect system is that they use an arc lamp instead of the usual tungsten or carbon. This arrangement not only has the advantage of lower cost in operation, but is claimed to give an effect more nearly equivalent to daylight than any other form of illuminant.

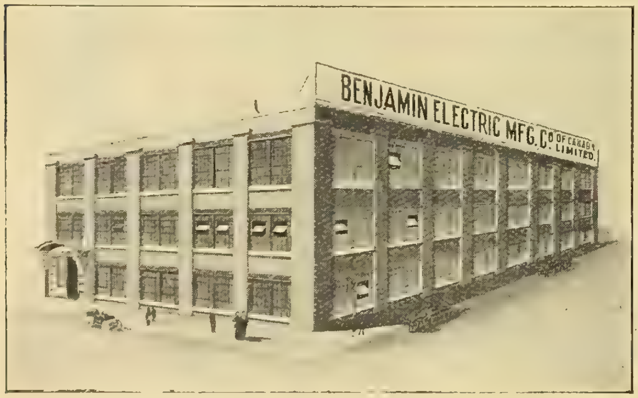
In addition, the Canadian Union Electric Company will also undertake the supply of complete electrical equipments for power plants of all descriptions.

For the Customer's Convenience

The accompanying cut illustrates a paste board box in which all Pass & Seymour equipment is now shipped. The cut shows a band extending around the centre of the box. This band is a seal, placed there so that the customer can see at once whether the box has been opened. In filling an order it saves him the time of opening the box to see if someone has removed any of the contents. If the seal is intact it is at once known that the box contains the quantity called for by the label.

New Benjamin Factory

Among the many United States companies which have opened factories in Canada few have shown such rapid growth as the Benjamin Electric Mfg. Co. of Canada, Ltd. Starting manufacturing in a small way in 1906 they have three times outgrown their quarters and finally have built a fine plant of their own at 11-17 Charlotte street, Toronto, where they are now located and manufacturing on a larger scale than heretofore. Everyone knows of the rapid growth of the electrical business in the Dominion and the demand for "goods made in Canada." The Benjamin company in addition to their new building have added a great quantity of new and modern machinery so that they are now in a position to manufacture in Canada material and devices which heretofore have not been made in the Dominion but which had to be imported. This means a great deal to the electrical trade in the way of shipments and will do away with the many inconveniences experienced in importing goods from other countries.



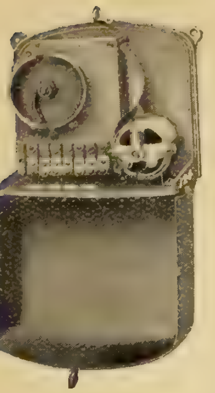
The new building, shown herewith, is of mill construction and has approximately 30,000 feet of floor space. One of the main points considered was that of sufficient and proper light both by day and night. As will be noted from the above cut every inch available was given to window space. For night illumination two types of lighting equipment are installed, one, of the deep bowl type, in the stock rooms and assembly departments, with the shallow type in the machine shops. Benjamin Reflector Sockets are used in this equipment and it is a noticeable fact that it is unnecessary in any instance to use individual drop cords over any machine. As a result both the quantity and the quality of the work will be increased and the products of this factory will be those of skilled workmen operating at all times under the most favorable conditions.

The engineering department of the company is developing and getting under way complete lines of standard devices so that within the next few months the Canadian electrical trade will be able to purchase practically all of their electrical devices "Canada Made." Mr. George C. Knott is the general manager of the company; Mr. Morgan P. Ellis, sales manager; Mr. S. T. Faram, superintendent, and Mr. H. E. Bullis, factory manager.

Northern Electric-Sturtevant Vacuum Cleaners

The Northern Electric and Manufacturing Company, Limited, have recently been appointed sole agents in Canada for vacuum cleaners manufactured by the B. F. Sturtevant Company, and in conjunction with this latter company have developed and brought out a complete line of portable and stationary types of Northern Electric-Sturtevant vacuum cleaners, covering all classes of vacuum cleaning work. The Northern Electric-Sturtevant cleaners are built on the well known Sturtevant fan principle, one of the chief features of the complete line being its extreme simplicity, without any delicate and carefully adjusted parts liable to get out of order. The only moving part of the cleaner is the fan, which is of strong construction and attached to the end of the motor shaft. The high speed motor in conjunction with the fan creates a very strong, powerful, and even suction. This is as strong as the fabrics of carpet and upholstery can stand without injury. On all these cleaners the dust bag is entirely enclosed, making a much neater machine, and overcoming any possibility of the dust being circulated around the room. The line comprises five portable types, from the smallest machine for household use, to the large portable type for large hotels and public buildings. There are also three types of stationary cleaners which have been standardized, and which are adaptable for residences and small public building work. For large public buildings, large offices, and railroad work special machines will be estimated on.

Cabinet-Type Motor-Driven Flasher



A distinct advance in flasher construction has recently been brought out by the Reynolds Electric Flasher Mfg. Co., in the form of a compact, enclosed-in-iron-cabinet, simple and reliable motor-driven flasher as shown in the accompanying illustration. The open cover shows the inner parts which consist of a power motor specially built for this work, a train of gears, a revolving brush, four contacts and the necessary fuses and terminals. The only moving current-carrying member is the brush which reduces the wear and tear and liability for trouble to a minimum. With this method an unusually quick make and break is obtained so that loads up to ten amperes per contact are handled with little or no arc. This equipment meets all underwriters' rules. The size of the flasher is 10½ in. x 9½ in. x 5½ in. so that it requires a very small space for installing.

The "Nulite"

Ever on the alert to give their many customers the best value that can be had for their money, The Canadian Tungsten Lamp Co. announced in our last number the introduction of their latest tungsten lamp which they have very appropriately christened the "Nulite." Made of pure tungsten drawn wire and with a continuous filament, they claim they now have a tungsten lamp that may be handled with as much impunity as a carbon lamp, thus eliminating the former objection to tungsten lamps that they are easily broken in handling. Two years of experiment have been spent to get this result, involving a large amount of worry, labor and expense on the part of the manufacturer, in order that the consumer may be supplied with the best that science can produce. Increased efficiency in service is, evidently, the keynote of this enterprising company's work and their large list of satisfied customers testifies to what extent their efforts are being appreciated by the dealer and consumer throughout the country.

Northern Electric Personals

The annual General Conference between the general staff and district managers of the Northern Electric and Manufacturing Co., Ltd., was held in Montreal from Dec. 2nd to 4th. The conference, which was most successful, terminated with a dinner and theatre party on the evening of Dec. 4th.

Mr. W. J. Doherty, supply sales manager, has been appointed to the office of the Jovian Statesman for the district of United States and Canada, for the year ending Oct. 15, 1913.

Mr. A. D. Smith, of the railway department, left recently on an extended business trip which will likely take him as far west as the Pacific Coast.

Mr. L. A. Burdick, of the Calgary house, has been elected Statesman of the society of The Rejuvenated Sons of Jove, which was recently organized there.

Mr. W. F. Uhl, of the specialty department, at Winnipeg, left recently for a brief visit to his home in Iowa. From there he goes to Montreal to join the sales staff of the Imperial Wire & Cable Company.

Mr. E. B. Beemer has been appointed head of the wiring specialties and house goods department at Winnipeg, taking the position of Mr. E. A. Lowden, who recently resigned.

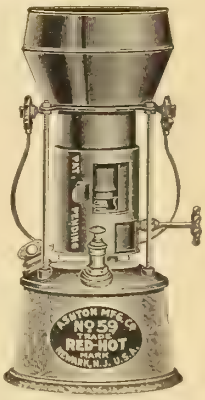
The Winnipeg house of this company has commenced a series of educational meetings which will be held bi-weekly during the winter. These meetings are attended by the sales, service and stock room staffs. The object of the meetings is to familiarize the men more thoroughly with the various lines of merchandise the company are handling as well as to acquaint them with sales methods. The first meeting was held on the evening of October 30th, with twenty-five present. H. C. Bentz, district sales manager, presided. He explained the object of the meetings and gave a general idea of what was expected to be accomplished by them. The second meeting was held on Wednesday evening, November 13th, with twenty-seven present. On this occasion H. F. MacGuyer, sales representative of the D. & W. Fuse Company, Providence, R. I., was present, and gave a sales talk on the "D. & W." lines.

Westinghouse Turbo-Alternators

The Railway and Lighting Department of the Canadian Westinghouse Co., Ltd., of Hamilton. Ont., have issued a booklet descriptive of Westinghouse turbo-alternators. The booklet outlines the history of the steam turbine and its development during the past 17 years. This company makes a specialty of a combined impulse and reaction turbine in which an impulse wheel is substituted for the smallest section of reaction blading, a design not claimed to give greater efficiency so much as that it reduces the length of the machine materially and gives a stiffer design of rotor. This type of turbine is fully illustrated and described in its three varieties—the single flow, the double flow, and the semi-double flow modification. The various parts of a turbo-generator and auxiliary governing equipment are also carefully described.

Torches and Fire Pots

A catalogue has just been issued by the Ashton Mfg. Co. of Newark, N. J., makers of gasoline torches and fire-pots for all mechanical purposes. Particular attention is given in this catalogue to a new kerosene fire-pot just placed on the market by this firm. It is claimed for this fire-pot that kerosene, as fuel, is less expensive than other things and is always obtainable. A perfect blue flame of intense heat is guaranteed. The tank is made of heavy galvanized iron thoroughly braced, and the burner is fitted with needle and packing nut, giving the operator perfect control of his equipment. The accompanying cut illustrates the kerosene fire-pot.



Browett-Lindley Canadian Agency

The John McDougall Caledonian Iron Works Company, Limited, of Montreal, have been appointed exclusive agents for Canada for the high-speed steam engines built by Browett, Lindley & Company, Limited, of Manchester, Eng. The "Browett-Lindley" enclosed, forced lubrication, double-acting engines are simple in construction, and, owing to the efficient system of lubrication and perfect balance of the moving parts, run silently and steadily under all conditions of load. This company has made a specialty of building engines for driving dynamos since the earliest days of the electrical industry. The "Browett-Lindley" is in use in the largest electric light and tramway stations, as well as in the most important collieries, steel and iron works, cotton and paper mills, etc., in England, and has earned an enviable reputation for economy and high efficiency.

The Automatic Surveyor Level

Among the new improvements being brought to the attention and use of the engineers of to-day, is the new Automatic Surveyor Level, recently invented by M. J. Dikeman, of New York City. This Automatic Level will not only take the grades, but will measure the horizontal distances, establish stations every 50, 100 or 200 feet, as desired, and produce a complete profile map of the line of survey. It is claimed that its design is so complete that it will do the work of the entire levelling party. These instruments have been under construction for several years, many designs being built before a perfect machine was obtained. While the instrument is quite complicated, the working and operation is very simple, and the entire work is accomplished by one man, in less than one-tenth of the time required by the usual surveying party; and without the liability of error or mistake.

The level is an electrical instrument, mounted on a suitable vehicle, and after the record sheet is placed on the rolls, the instrument being adjusted or levelled, is ready for work, the entire record and data being taken by drawing the vehicle over the line of survey, making an instantaneous record of every thing over which it passes.

The principle upon which the instrument is designed, is based on the law of gravity. The various motions required to produce the records, are mostly obtained through the use of friction discs, governed and controlled by an electrical device, which increases, decreases, and reverses the motion regulating and controlling the recording device. The capacity of the level is from 15 to 20 miles per day, depending upon the condition of travel, and the roughness of the ground to be passed over. It is especially adapted to the preliminary surveys on any class of work and will be of great value in irrigation and railway work, although it is equally as well adapted to the usual classes of city work in paving, sewers, and general work. These instruments are being manufactured by the Dikeman Surveyor Company, of Detroit, Mich.

Eclipse Electric Cookers

The Electric & Ordnance Accessories Co. Ltd., have received an order from the Westminster Electric Supply Corporation, Ltd., of London, England, for 50 Eclipse cookers of a new pattern, these cookers being intended for hiring-out purposes. Designs were submitted by a number of other cooker manufacturers, and the contract was placed after severe tests.

The Electric & Ordnance Accessories Co., Ltd., are represented in Canada by Messrs. Canadian Vickers Ltd., office, 20 Bleury street, Montreal.

Order for 15000 Kw. Turbo Generator for Manchester

The Siemens Company of Canada have recently received an order from the Manchester, Eng., Corporation for one 15,000 kw. turbo-generator, 3-phase, 50 cycles, 6600 volt, 1000 r.p.m., to be direct coupled to a Zoelly turbine manufactured by Messrs. Howden & Company. The Siemens company have already delivered four turbo-generators to the Manchester corporation with outputs of 4500 kw., 6000 kw., 6000 kw. and 7500 kw. respectively, and this new order serves to show the satisfactory operation of their apparatus. This company have built over eighty turbo-generators with an output of 4000 kv.a. or over, among which is one having a continuous output of 21,500 kv.a.

The wording of the franchise which it is proposed to give the Stratford Railway Co. in the city of Stratford, Ont., has been revised again and, it is said, is practically agreed upon by the two parties. It is being submitted to the ratepayers at the New Years' elections.

Ignition and Lighting Sets

"Westinghouse Electric Ignition and Lighting System" is the title of a handsome catalogue just issued by the Westinghouse Electric & Manufacturing Company, describing and illustrating in detail the new ignition and lighting system for gasoline automobiles recently placed on the market by this company. The book has an attractive art cover, and is printed by the off-set process. Complete detail views, together with diagrams are given of the apparatus, as well as a thorough description of the methods of construction of same. In addition to the ignition and lighting sets, a number of other automobile accessories, manufactured by the company, are described, such as the vibrating rectifier, automobile tire vulcanizer, and wiring details used in connection with the ignition set.

Aluminium

The British Aluminium Co. of 109 Queen Victoria street, London, E.C., have issued a booklet called "Aluminium" which outlines the use of this metal in a number of different industries, e.g., the automobile industry; in aerial navigation; in the electrical industry as cable, busbars, and switch board connections; in the railway field and in many miscellaneous ways. The same company are also distributing reprints from the Electrical Review and Electrical Engineering together with letters from prominent engineers, explaining the characteristics of copper and aluminium in transmission line work and the entire satisfaction given by aluminium in installations made by these engineers.

Attractive Advertisements

A new feature in advertising electric appliances and other equipment has just been introduced by the Ottawa Electric Company. Big posters displaying electric irons, electric heaters, etc., have been posted on the bill boards in the city. There is a picture of a girl with her hand on a switch showing how all the articles can be operated, if so desired, by this one switch on the light bracket. At night two powerful electric lights, hidden under reflectors, show the posters up to advantage.

Low Frequency Flicker Cured by Two-Phase Wiring

The Electrical World quotes an instance of a large factory in which the lighting from the 25 cycle two-phase mains gave considerable annoyance by its flickering. A way out of the trouble was found by wiring half the lamps on one phase and half on the other, The peak of one phase coincided with the valley of the other, and the flickerings neutralized each other, with the result that no unevenness in the illumination on the working plane could be detected.

Dissolution of Partnership

The firm known as Vandeleur & Nichols, comprising Mr. J. B. Vandeleur and Mr. R. H. Nichols, is in process of dissolution. The business, however, has been actively managed by Mr. Nichols for the past few months, and it is the intention of Mr. Nichols to carry on business in the same lines as heretofore.

H. W. Johns-Manville Company

The H. W. Johns-Manville Company have recently opened a new southern warehouse in Atlanta, Ga. The entire building, embracing three floors and a basement, with a total floor area of about 10,000 square feet, will be utilized exclusively as a warehouse for a stock of such J-M products as roofing, boiler and pipe coverings, cements, packings, fire extinguishers, electrical, railway and automobile supplies.

West Lorne Installing a Gas Producer

The West Lorne Electric Light Co. have been granted a twenty-five year franchise by the town and expect to have a practically new plant in operation by February 1, 1913. A new 65 h.p. type R. multi-cylinder producer-gas engine is being installed which will drive a couple of small d.c. generators already in the power house. The producer is a Fairbanks-Morse, of the suction type and will be arranged for belt connections to the line shaft. At the outset the plant will be used for illuminating purposes only, but it is hoped later on to give a 24 hour service.

Smart-Turner Pumps

The Smart-Turner Machine Co. of Hamilton, Ontario, are supplying duplex pumps to Mr. Wm. Bermingham, Goderich; The Pratt & Whitney Co., Dundas; Mr. Stephen Wellington, M. E., Madoc; and the Breslau Brick Co., Breslau, Ont. The same company are also installing at the present time a rotary pump for Mr. W. A. Mustard, Baysfield, Ont., and a centrifugal pump to Mr. L. H. Couillard, East Angus, Que.

The Stone & Webster Corporation who are constructing the street railway system in Saskatoon and who have also drawn plans for a railway system in Prince Albert now have their auditor in Saskatoon working out a system of bookkeeping by which the street railway operation can be taken care of along with other municipal enterprises with the least possible friction.

The gas producer seems to be coming into its own, although development along these lines is slow. The tremendous increase in the price of fuel oil has been a great factor in bringing the producer to the attention of a great many people who use gas for both fuel and power purposes.

The Bell Telephone Co. have submitted a proposition to the London city council offering $4,000 a year and $600 worth of free telephones for a three years' renewal of their exclusive franchise.

The ratepayers of Ward 7, Toronto, are asking the city council to make application to the Ontario Railway and Municipal Board for an order compelling the Toronto Railway Company to build a line on Bloor street, west from Dundas street to Quebec avenue.

Preliminary surveys have been made for an electric railway to connect Taber, Alberta, with certain coal mines in the neighborhood and it is said a charter will be applied for in the near future by a number of Calgary men.

The Telkwa Light and Power Co., Ltd., has been incorporated with the usual wide powers. The head office of the company is Victoria.

Trade Publications

High tension fuses:—Bulletin No. 1 issued by the Delta-Star Electric Co. of Chicago, descriptive of S. and C. high tension fuses.

Flashers:—Bulletin No. 24 issued by the Reynolds Electric Flasher Manufacturing Co. of Chicago and New York, descriptive of their cabinet-type flasher.

T. T. C. Equipment—The Tungstolier Co. of Canada has recently issued a catalogue covering their line of T. T. C. tungstoliers. This catalogue will be found of unusual interest to the dealer or contractor interested in illumination.

Governors—The Escher Wyss & Co. are distributing from their Montreal office, a pamphlet describing their universal oil-pressure governor for water turbines. This pamphlet deals particularly with sizes for small and medium size turbines.

Supply Catalogue: Section 4, second edition issued by the Canadian General Electric Co., Ltd., of Toronto, descriptive of snap, flush and knife switches. The catalogue contains 76 splendidly illustrated pages of descriptive matter on this apparatus.

Blue Printing: A booklet issued by the C. F. Pease Co.. 166 West Adams street, Chicago, describing blue print machinery, blue print room supplies, direct white print machinery, drafting room furniture and supplies as manufactured by this company.

Insulators:—Booklet issued by T. C. White, manufacturer, St. Louis, descriptive of porcelain strain insulators. This booklet shows cuts, with descriptions, weights, dimensions, tests, etc., of the improved type of porcelain insulator manufactured by this company.

Electrical Books.—The D. Van Nostrand Company, of 25 Park Place, New York, have just issued a new catalogue of their books on electricity. The books are classified by subjects and appear to cover very thoroughly, the whole range of electrical knowledge and practice.

Presto: A booklet issued by the Pass & Seymour, Inc. of Solvay, N.Y., suggestive of the advantages to be gained by using P.&S. interchangeable sockets and receptacles. From fifteen parts it is possible to make up twenty-four different combinations of sockets or receptacles. The methods of interchange are shown by a clever illustrated device.

Westinghouse: The Westinghouse Electric & Manufacturing Co. of East Pittsburgh, Pa., have recently issued the following; sheet 2441-A outlining points of importance in selecting and applying small motors; a booklet entitled "The Westinghouse Sewing Machine Motor;" a booklet entitled "Electric Ware," describing, with illustrations, the various household equipments manufactured by this company; a booklet entitled "A.C. watthour meters;" a booklet entitled "Westinghouse motors;" the Textile Quarterly No. 2 published by the Industrial and Power Department, describing motor drive for worsted and woollen looms; publication No. 1203 descriptive of their electric ignitor and lighting system for automobiles; sheet No. 2485 describing Westinghouse low pressure turbines.

New Books

Alternating-Current Machinery,—by William Esty, S. B., M.A., Head of the Department of Electrical Engineering, Lehigh University. American School of Correspondence, Chicago, publishers. 475 pages, well illustrated. This treatise has been prepared with the special object of giving the beginner, and the practical engineer who has not had the advantage of a technical training, a working knowledge of alternating machinery and how to install and operate it. The reader is assumed to have some knowledge of the elementary laws of electricity and magnetism but practically all the higher mathematics has been omitted and graphic methods have been adopted wherever possible. The subject matter is treated under the following heads,—alternating-current principles, measuring instruments, alternators, synchronous motors, transformers, conversion of a.c. to d.c., induction motors, switchboard and station appliances. There is no doubt that a close study of this book will go far towards fulfilling the object for which it was written and will add much to the useful knowledge of the reader and student.

Current News and Notes

Aurora, Ont.

The council has passed a by-law to purchase the equipment of the Aurora Electric Light Company.

Ashcroft, B.C.

Following a notice sent out by the Ashcroft Water, Light & Power Company that customers in future must come to the office to pay their bills by a certain date, and that no bills will in future be rendered a number of citizens who refuse to conform to the new rules were threatened with disconnection from the service. One of the customers seeks an injunction to restrain the company from carrying out its alleged threat.

Acton, Ont.

A by-law is being submitted on January 6th to authorize the issue of debentures to the extent of $8,500 for completing the distribution system.

Bobcaygeon, Ont.

The village electric light power house was destroyed by fire recently. This was a small water power plant owned and operated by the municipality. The loss is estimated at about $5,000, which includes the generators.

Chesterville, Ont.

A power and lighting system is contemplated.

Cobalt, Ont.

A by-law to raise $60,000 to cover cost of plant extension and distribution is being submitted.

Cornwall, Ont.

A by-law was submitted on Monday, December 23rd, asking approval of an agreement between the town of Cornwall and the Stormont Electric Light and Power Co. The company agrees to install and operate two hundred 110-volt, 75-watt tungsten lamps for $2,000 a year or at the rate of $10 each, lights to burn from sunset to sunrise every night. The by-law provides that a ten-year franchise be given the company under these conditions.

Clinton, Ont.

A by-law will be submitted at the New Year elections to raise $33,000 to purchase the Clinton electric light plant and erect a transformer station. Power will be obtained from the Hydro-electric Power Commission of Ontario at $39 per h.p. on the supposition that a number of towns in the district take 1,500 h.p. between them.

Chatham, Ont.

It is reported that Mr. D. A. Gordon, of Wallaceburg, has taken over the Chatham, Wallaceburg and Lake Erie Railway. It is further reported that the purchase has been made for the C. N. R.

Calgary, Alta.

Property owners in certain suburbs of this city have offered to build an extension of one and one-half miles to the Manchester street car line at their own expense and make a present of it to the city, the only condition attached being that the city will operate cars on it. The proposed agreement also protects the city against any loss incurred by operation of the lines during the first three years.

Commissioner Graves has made the interesting report that by using natural gas under their boilers instead of coal at $3 a ton, a saving of between $25 and $30 per day is made in Calgary's fuel bill. The city is under contract with a natural gas company to take 10,000,000 cubic feet of gas per month at 15c per M.

It has been recommended that a water tower be erected near the reservoir and a motor-driven turbine pump installed.

Dauphin, Man.

Councillor Malcolm is advocating erection of cluster lights on the main thoroughfares.

The town council recently decided to install a new plant with three times the capacity of the present equipment which is at present overloaded. It was suggested that the exhaust steam be used for heating purposes.

Dryden, Ont.

A by-law has been introduced in council to take over the electric lighting system of the Dryden Timber and Power Company, and run it as a municipal proposition.

Esquimalt, B.C.

A contract has been closed with the B. C. E. R. Co. to supply lights and power for street illumination in this village. The terms of the agreement permit the municipality to pay for the work in five equal annual instalments with interest at 6 per cent. The B. C. E. R. Co. will install a system capable of supplying 250 lights, though all of these will not be installed immediately.

Fort William, Ont.

A strike is threatened on the Port Arthur and Fort William Electric Railway System.

Galt, Ont.

At the January elections Galt will elect a hydro-electric commission to have charge of electrical matters here. This is in accordance with a recent Provincial Act, giving municipalities power to make such appointments.

A movement is on foot to illuminate the road connecting Galt and Preston, a distance of about two and one-half miles. The Galt, Preston & Hespeler Electric Railway line follows the road it is proposed to illuminate.

The Brantford & Hamilton Railway Company, a subsidiary of the Dominion Power and Transmission Company, has given notice that it will apply for authority to construct a railway line from a point near Langford to a point in or near Galt.

Gananoque, Ont.

Notice of application will be made to next session of Legislative Assembly of Ontario for an act to incorporate F. A. Henry, R. A. Sibbitt, J. C. Judd, all of Ottawa; W. T. Sampson, Gananoque, J. A. Donevan, Toronto, F. B. Taber, Morton, and D. W. Green, Lyndhurst, under the name of the Gananoque, Perth & Lanark Ry. Co., company to construct and operate line to use steam, electricity or other motive power between Gananoque and Lanark, with branch from near Morton through Lyndhurst and Delta to Portland.

Halifax, N.S.

The city is making a three-year contract with the Halifax Electric Tramway Company to provide street lights at a rate of $60 per arc light.

It is proposed to ask the Provincial Legislature to interfere in behalf of the city in the latters attempt to regain control of the electric railway franchise. The city is now eager to buy out the railway system and operate it as a municipal enterprise.

Humboldt, Sask.

A contract has been awarded for power house equipment as follows: engine and boilers, E. Leonard & Sons; electrical equipment, Canadian General Electric Co. Chipman & Power, Mail & Empire Bldg., Toronto, are consulting engineers.

Hamilton, Ont.

Negotiations are in progress between the Hamilton Street Railway Company and the city, which may result in the increase of the present track mileage by about fifty per cent.

The Hamilton Street Railway Company has been requested to build certain extensions in various parts of the city. If the company declines to make these extensions it is suggested that the city may build them.

Street railway employees have accepted the following offer of the company: 20c, 22c and 25c per hour respectively for the first three years with 2c extra per hour for over time.

It is announced that the city is already using more than the 2,000 h.p. contracted for and Mr. H. C. Barber, manager of the system, has been instructed to make application for 1,000 h.p. more.

Kamloops, B.C.

Tenders are called for 1,000 h.p. steam pumping and electric equipment.

Kingston, Ont.

In the event of the Street Railway Co. not being able to come to satisfactory terms for the renewal of the contract for a supply of power to operate the railway, it is reported that the company will install a steam plant of their own. At the present time power is purchased from the city at the rate of 1.2c. per kw.h.

Mr. H. W. Richardson, President of the Kingston, Portsmouth and Cataraqui Railway Co., has advised the representative from the joint committee of Utilities and Board of Works that this road is not for sale. Recently the city of Kingston decided to open negotiations re the purchase of this road to be operated as a municipal enterprise.

London, Ont.

Owing to strenuous opposition on the part of business men, the city council

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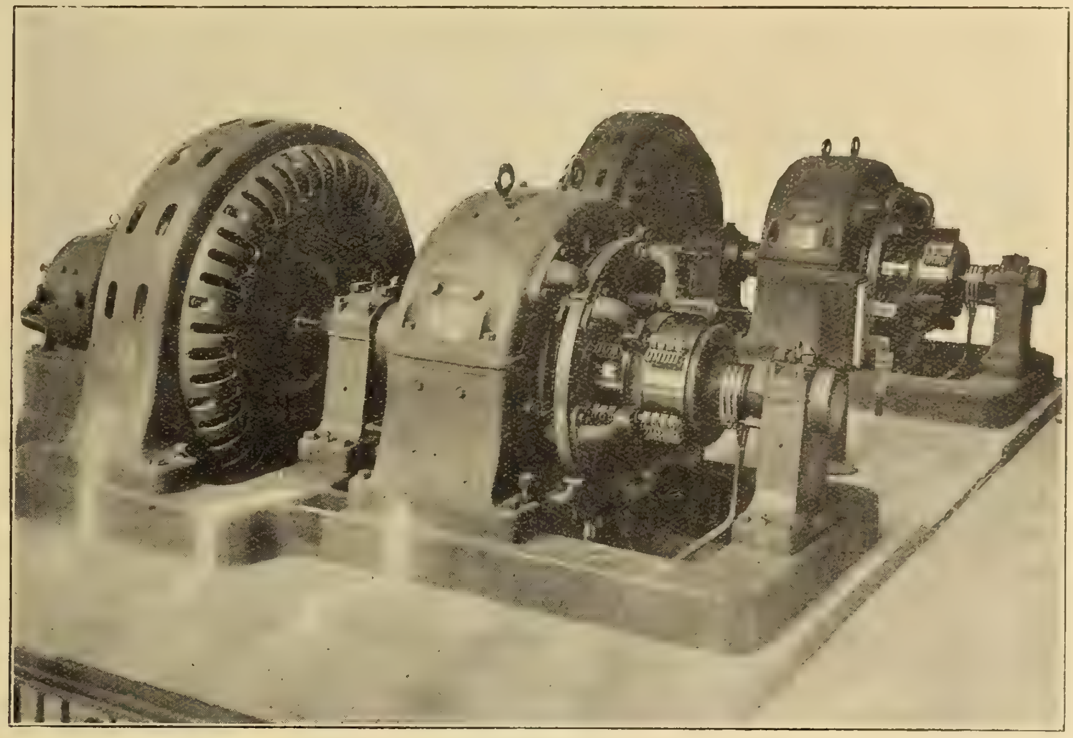

Attention is especially drawn to the Siemens two piece commutator shown above. This type of construction has been standard with us for a number of years and used when the length of commutator exceeds about 11 inches. The two sections are on the same bolts and connected by lugs so arranged as to form vanes and produce a current of air to pass through the two sections. The commutator is the same electrically, but mechanically it is far stronger, and in addition the following advantages are obtained:—

Thorough ventilation. Cool running assured. Short commutator bars used. Distortion due to temperature or mechanical stresses avoided. Surface always in good condition. Brush spindles supported from middle of short rigid support.

This construction has met with very favorable comment from many Canadian engineers.

We have delivered or on order for Canada the following motor generators:—

1—800 K.W. Canadian Collieries, Victoria.
1—700 K.W. Canadian Collieries.
2—500 K.W. City of Winnipeg.
1—250 K.W. Canada Sugar Refining Company.
1—200 K.W. City of Lethbridge.
2—70 K.W. Winnipeg Technical Schools.
1—800 K.W. Dominion Coal Company.
2—500 K.W. City of Port Arthur (one of which is a repeat order).
1—400 K.W. City of Lethbridge.
1—220 K.W. Dominion Coal Company.
1—100 K.W. Northern Ontario Light & Power Company.
1—70 K.W. Larimer Company, Winnipeg.

Siemens Company of Canada, Limited

HEAD OFFICE:

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WINNIPEG

have decided to allow the by-law dealing with the electrification of the London and Port Stanley Railway to stand over. It was the original intention to submit this by-law on January 1st.

It is said surveys will start at once for new radial lines between London, St. Mary's, Sarnia, Chatham and Windsor.

Following the objection raised by one of the aldermen that the sum of $30,000 was too large an amount to pay for street lighting, Prof. Angus, of the University of Toronto, has made a report in which he names $19,000 as a reasonable sum.

Lethbridge, Alta.

Operating figures to date of the Lethbridge street railway system recently handed out by Superintendent Arthur Reid show that for the first eighty-four days of operation the total earnings were $15,159, or a daily average of $182. As the daily expense of operation, including interest and sinking fund is placed at only $190, it is hoped that the first year will easily see the system carrying its own charges. The new turbo-generator is reported to have been started up during the early part of December.

Moose Jaw, Sask.

City Engineer Antonisen, following his return from a trip of inspection of a coal property some forty miles south of this city, has stated his belief in the possibilities of cheap electric power from this point. The natural plan would be to construct a development plant in the coal fields and transmit energy at a high voltage to the city.

In a report recently made by Mr. B. F. Haanel, Ottawa, on the coal deposits in the neighborhood of Moose Jaw, it is stated that this lignite is particularly well adapted for use in a producer gas plant.

Montreal, Que.

Plans of the location of the ornamental light standards on St. Catherine St. from Papineau to Atwater ave. were submitted to the Board of Control by Superintendent Parent of the city Light Department. The plans call for 142 standards.

North Bay, Ont.

A by-law is being submitted, asking power to borrow $60,000 for electric distribution system.

Niagara Falls, Ont.

It is said the Electric Light Commission of this place will lay in a stock of tungsten and carbon incandescent lamps and the various articles of household equipment to be sold to users of electric power at cost.

The Niagara Falls Queen Victoria Park Commission have given permission to the Ontario Power Company to enlarge power house and install two more units of 13,500 h.p. each, including turbines, generators, governors, switchboard, penstock, etc.

Nelson, B.C.

It is said the street lighting system here will be in operation by the beginning of the year. Three light standards are being installed.

Owen Sound, Ont.

A by-law will be submitted at the New Year to authorize the issue of $50,000 debentures to meet an overdraft and to cover needed extensions at the electric light plant. It is suggested that automatic stokers be installed and low pressure steam turbine to operate by exhaust steam.

Ottawa, Ont.

A by-law is being submitted to authorize the Ottawa Electric Railway Company to construct certain extensions to their line.

Orillia, Ont.

A by-law will be submitted providing for the placing of the municipal enterprise under a Water, Power and Light Commission.

Parry Sound, Ont.

A by-law to raise $5,500 for altering and improving the electric light plant, is being submitted.

Port Arthur, Ont.

The city council has recommended the purchase of four pay-as-you-enter cars for their main line.

A by-law is being submitted to expend $12,000 for the purchase of a motor-generator at Port Arthur. A by-law is also being submitted, asking authority to issue debentures for $6,550 for extensions to the lines of the street railway system.

Port Colborne, Ont.

The Ontario Power Company is constructing a one-storey, 35 x 75, concrete foundation, steel and brick construction, sub-station here.

The Ontario Power Company has promised to readjust the electric lighting rates after the new year.

Port Dalhousie, Ont.

A by-law is being submitted, authorizing the appointment of a Light and Heat Commission to manage the reception, distribution and supply of electric power.

Peterboro, Ont.

A by-law is being submitted to the ratepayers on January 1st, authorizing the expenditure of $120,000 on a municipal lighting system.

Prince Albert, Sask.

The by-law to expend three-quarters of a million dollars on a hydro-electric power proposition is being again submitted to the electors owing to some little technicality that was formerly overlooked.

Port Alberni, B.C.

Contract has been awarded for one Diesel oil engine to Mather-Yuill & Co., 429 Pender street, Vancouver, and for one 100 kw. generator and switchboard to the Canadian General Electric Company.

Quebec, Que.

The Board of Conciliation has been instrumental in settling the wage dispute between the Quebec Railway Light, Heat & Power Company and its employees. First year men now get 17½c., second year 18½c., third year 20½c., eight year 21½c., thirteenth year 22½c. per hour. After November 1st, 1913, this schedule is increased 1c. per hour all round.

Revelstoke, B.C.

The Revelstoke City Council have decided to proceed at once with the installation of an arc lighting system stretching for about two miles from the C. P. R. station to Columbia River bridge.

Rosthern, Sask.

A by-law will be submitted to raise money for the installation of an electric light plant.

Richmond Hill, Ont.

The Toronto and York Radial Railway Company will supply this village with a street and house lighting service. Yonge street will be lighted with twenty-six 80-watt tungsten lamps. It is understood the work of installation will be done by the town and the company agrees to supply power at the rate of $26.50 per h.p. year. It is proposed to make a charge of 8c per kw. hour for house lighting. Considering that this town is some 110 miles from the source of supply a $26.50 rate for 50 h.p. would seem to be a specially favorable one.

St. Thomas, Ont.

The Commission reports that this city will show a surplus anywhere between $15,000 and $20,000 on the year's operation of hydro-electric light and power.

By-law is being submitted to ratepayers in January to expend $18,000 on street railway extensions.

Souris, Man.

By-law is to be submitted to expend $40,000 on an electric lighting plant.

St. Mary's, Ont.

The Water, Light & Heat Commission have complained that the rates charged the city by the Hydro-electric Power Commission of Ontario are too high, and state that power is being furnished at a lower rate to a private company in St. Mary's. An attempt will be made to obtain the same rate for the city as the private company is receiving.

The council is considering making an offer to its customers to allow each house to install one verandah lamp not over 55 watts capacity, for which no charge will be made for operation.

Stratford, Ont.

A new power line from Stratford to Sebringville is contemplated and plans and estimates will be prepared soon.

A street railway by-law will be submitted to the electors on January 6th. The company agrees to obtain its supply of power for the operation of the railway from the Hydro-electric Power Commission, provided the rates are as favorable as those obtainable elsewhere.

St. Catharines, Ont.

The city council has reconsidered its refusal to negotiate with the Hydro-electric Power Commission and will ask an estimate on cost of 2,000 h.p.

Toronto, Ont.

The Northern Electric & Mfg. Company, Ltd., have awarded to Clarke & Monds, 152 Bay street, a contract for factory and warehouse as follows:—cement foundation, reinforced concrete, brick, structural steel construction, concrete floors, felt and gravel roofing, metal sash, metal lath, gas and electric lighting, steam heating, vaults.

The Board of Control have asked Commissioner Harris to make a report on

The WESTON SYNCHROSCOPE

Constitutes a very simple and absolute *perfect solution* of problems involved in coupling alternating-current machines in parallel without danger or sensible disturbance of circuit conditions.

The indications are infallible.

There is only one object to observe

The movement of the pointer is smooth and certain; it inspires confidence.

It indicates exact synchronism within 1 deg. of true phase coincidence over a wide range of frequency and voltage.

Send for catalog giving full *description of this unique instrument* and also our full line of A. C. and D. C. instruments for Switchboard, Portable and Laboratory Work.

Demonstrations of the operative characteristics of these remarkable instruments may be observed in our New York Office and also in the offices of Selling Representatives in Philadelphia, Chicago, San Francisco and Toronto.

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Boston, 176 Federal Street.
Philadelphia, 342 Mint Arcade.
Birmingham, Brown Marx Bldg.
Detroit, 44 Buhl Block.

St. Louis, 915 Olive Street.
Denver, 231 15th Street.
San Francisco, 682 Mission St.
New Haven, 29 College Street.
Cleveland, 1729 E. 12th Street.

Toronto, 76 Bay Street.
Winnipeg, Montreal, Calgary, Vancouver } Northern Electric

London, Audrey House, Ely Place, Holborn.
Paris, 12 Rue St. Georges.
Berlin, Genest St. 5, Schoenberg.
Johannesburg, So. Africa, F. Peabody Rice, Standard Bank Buildings, Harrison St.

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Cablegrams "Insulator" Montreal
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Power Building, Montreal

the purchase by the city of six civic busses.

The Board of Control has passed a recommendation to install ornamental street standards on Victoria street.

Thirty-five members of the sales department of the T. E. L. Co. held a banquet recently at which Mr. P. H. Kemble, chief of the department, addressed the members on "The Policy of the Company."

The Hydro-electric Power Commission of Ontario and their chief engineer, Mr. F. A. Gaby, are actively carrying on negotiations looking fo the extension of their line west from St. Thomas to Windsor.

Vancouver, B.C.

Following negotiations between the parties concerned it has been decided that the B. C. E. R. Co. will be given special rights on B. C. Telephone Company poles on car line streets. This is intended to do away with as much extra pole construction as possible. It is understood the Telephone Company is prepared to sell the Railway Company a half interest in the poles.

Wallaceburg, Ont.

The Chatham, Wallaceburg & Lake Erie Electric Railway Company contemplate extensions to the electric lighting system of town.

Windsor, Ont.

An agreement has been signed with the Hydro-electric Power Commission of Ontario for the supply of 2,500 h.p. at a rate not to exceed $38 per h.p. This rate is given on the supposition that power will be required by a number of towns and municipalities in the neighborhood. Work will be commenced on the line from St. Thomas to Windsor early in the spring and in the meantime, supplies will be put in hand.

Wilkie, Sask.

By-laws to raise $10,000 for electric power plant extensions and $2,250 for extending the electric light system, passed recently.

Weyburn, Sask.

A by-law has been approved to expend $35,000 on additions to the municipal electric light system.

Winnipeg, Man.

An extensive railway scheme brought forward by the Porcupine Rand Belt Electric Railway Company, proposes plans to build a line connecting Winnipeg with Quebec city. In Quebec and in Ontario as far west as Lake Nipigon, it is proposed to locate the line between that of the G. T. P. and the C. P. R. From Nipigon west, it will lie south of the G. T. P. and north of both the C. N. R. and the C. P. R. It is stated that 75 miles of the road is to be surveyed this fall. The first section of the line to be constructed if this scheme goes through, will probably be from Larder city east to the Quebec boundary. In all probabilities self-contained cars would be used and there is some talk of storage batteries.

The Northern Electric & Manufacturing Company have been awarded the contract for thirty fire alarm boxes.

Tenders will be received until January 6th, by the Secretary of the Board of Control, for a supply of 500 to 1,000 electric flat irons.

The Winnipeg Electric Railway Company will likely be asked to make a proposal for extension of its Headingly line to Portage la Prairie.

Tenders will be received by the Secretary of Winnipeg Board of Control until January 24, 1913, for supply of three step-down transformers, 2,700 kw. each.

Commissioner Robson has issued an order for the joint use and ownership of poles by the Winnipeg Electric Railway Co. and the city of Winnipeg.

Yellow Grass, Sask.

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Electrical Engineer, McGill graduate, seven years' experience with steam, hydraulic and internal combustion generating plants, operation and construction, wishes position as superintendent of power system or with consulting firm. Will go anywhere but prefer British Columbia. Salary $2,000 per annum. Reply Box 666, Electrical News, Toronto, Ont. 1-3

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Draughtsman wanted, by Toronto Hydro-electric System, experienced on High and Low Tension, Sub-station Design. Good salary. Apply Station Department, 228 Yonge Street, Toronto. 1

Draughtsman — First-class, experienced in Switch Gear for High Tension and Low Tension A.C. work for large Hydro-Electric Plant in Canada. Must be neat, accurate, capable and able to do designing and layout work under supervision. Also Junior on similar work. Apply to Toronto Power Company, Niagara Falls, Ont., Canada. 1-2

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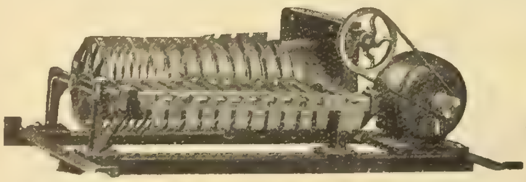

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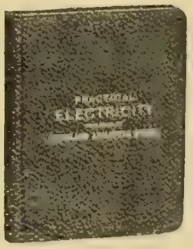

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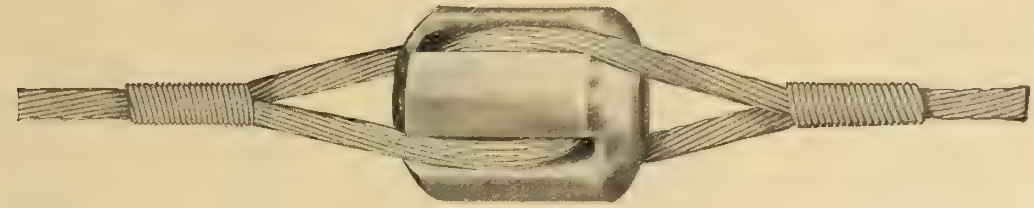

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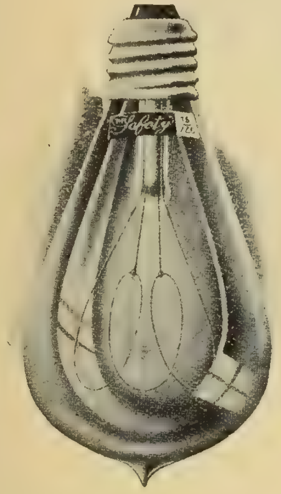

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Telegraphy, bp Sir W. H. Preece, K.C.B., and Sir J. Sivewright, M.A. Published in 1905 by Longmans, Green & Co., 504 pages. Price $1.00.

Electro-Dynamos, by Charles Ashley Carus-Wilson. Published in 1898 by Longmans, Green & Company. 298 pages, Price 50c.

Elementary Lessons in Electricity and Magnetism, by Silvanus P. Thompson. Published in 1895 by MacMillan & Company, 628 pages, illustrated. Price 50c.

Electric Lighting & Heating, by Sydney F. Walker, Published in 1907 by Norman W. Henley Publishing Company. 438 pages, illustrated. Price $1.00.

Dynamo-Electric Machinery, by Francis B. Crocker, E.M., Ph.D. Published in 1908 by American School of Correspondence. 236 pages, illustrated. Price $1.00.

Telephone Law, by A. H. McMillan. Published in 1908 by McGraw Publishing Company. 332 pages. Price $1.50.

Explanations of Switch and Signal Circuits. Published in 1907 by Doran & Kasner. 140 pages. Price 40c.

Elementary Electrical Calculations, by W. H. N. James, A.R.C.Sc. Published in 1905 by Longmans, Green & Company. 216 pages, illustrated. Price 50c.

Practical Alternating Currents and Power Transmission, by Newton Harrison, C.E. Published in 1906 by W. L. Hedenberg Publishing Company. 376 pages, illustrated. Price 50c.

Practical Methods of Electro-Chemistry, by F. M. Perkin, Ph.D. Published in 1905. 322 pages. Price $1.00.

Treatise on Thermodynamics, by Dr. Max. Planck. Published in 1903. 272 pages. Price $1.00.

Text-Book of Electrochemistry, by Svante Arrhenius. Published in 1902. 344 pages, illustrated. Price $1.00.

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Dissolution of Partnership

Notice is hereby given that following an application to the High Court of Justice of the Province of Ontario by Mr. R. H. Nichols, the partnership of the firm known as

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Mr. Nichols is continuing in business in the usual manner, at the same business address, Dineen Building, Toronto, and solicits the continuance of his customers' patronage.

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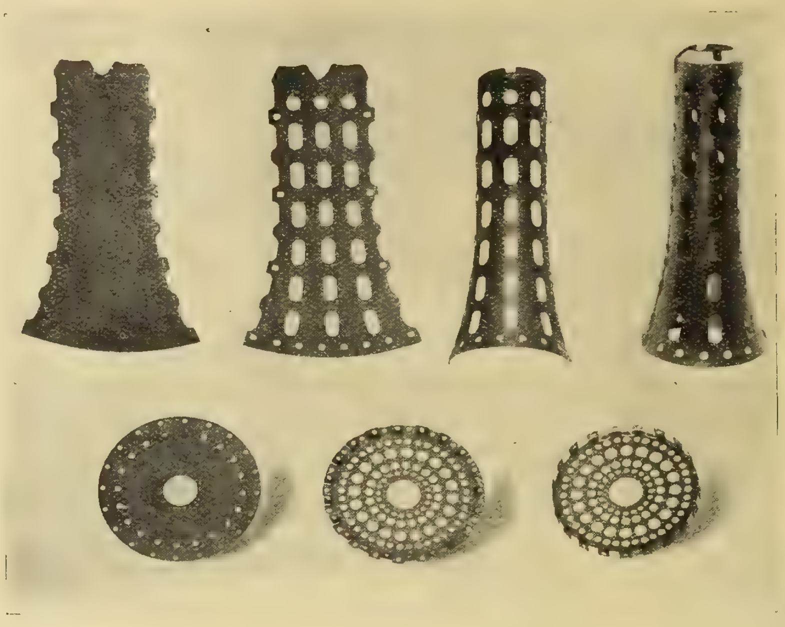

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The illustration in the upper left hand corner of this page is of a bunch of these reinforced parts in an oven. These have just been baking for forty minutes in order to eliminate all chemical action, after having been copper plated.

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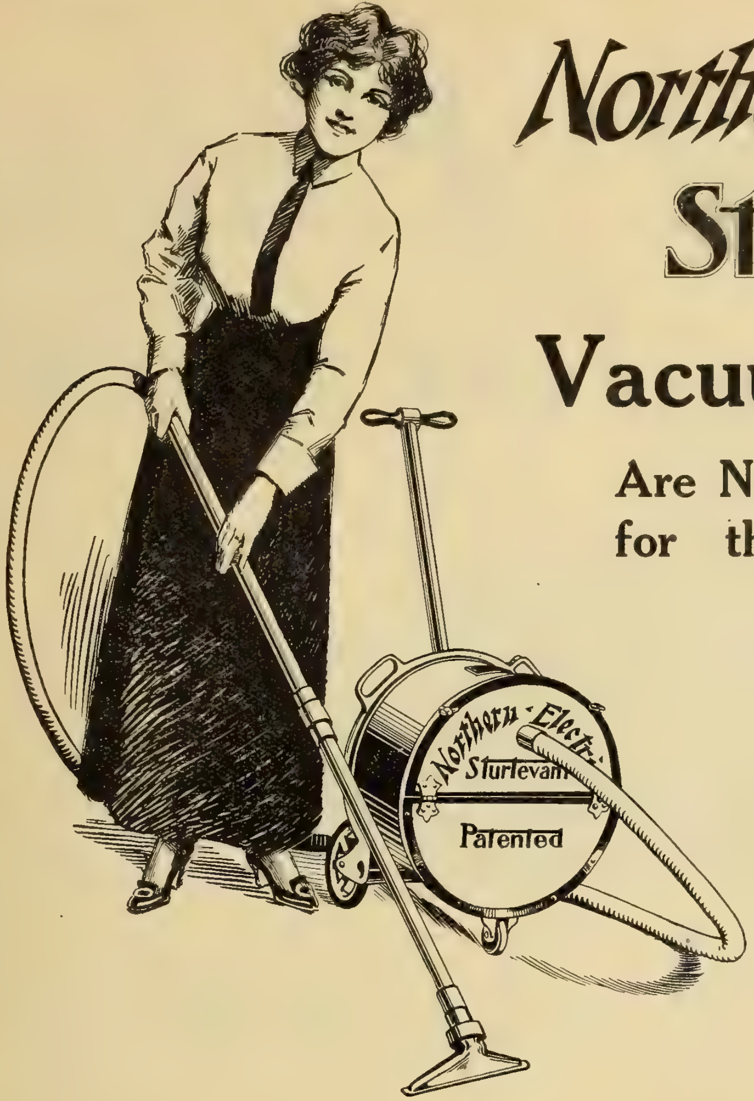

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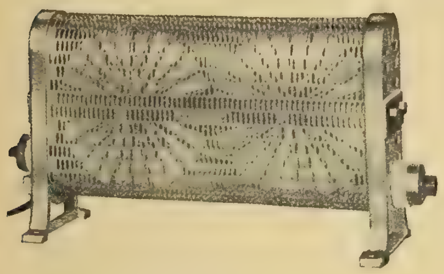

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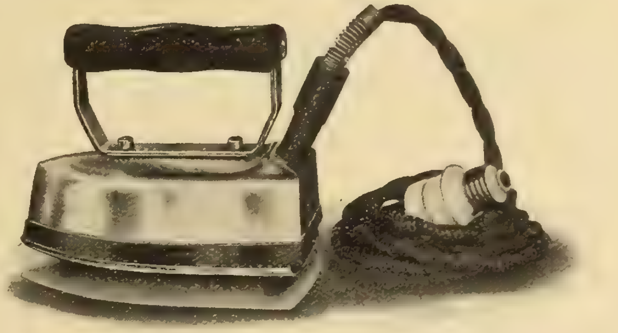

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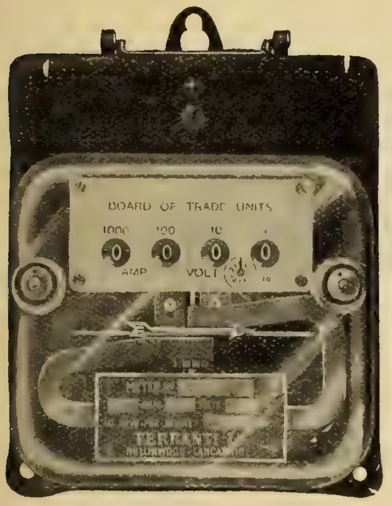

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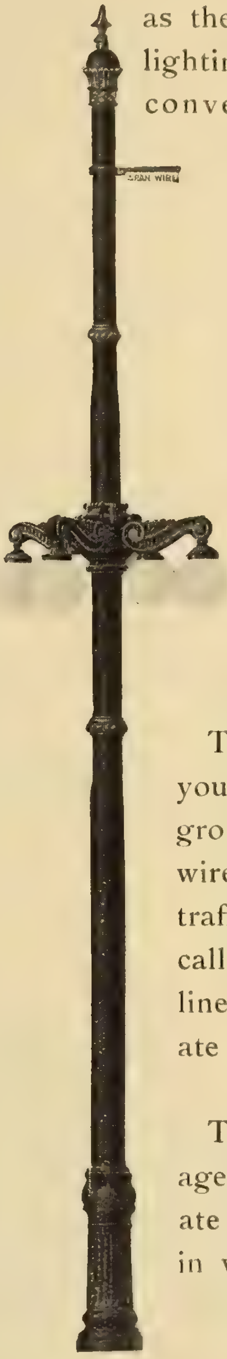

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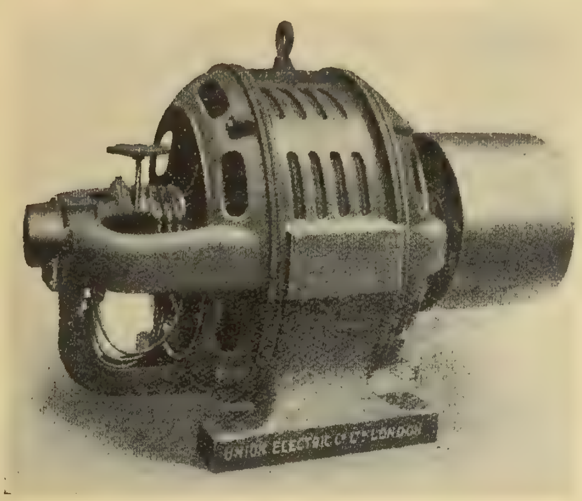

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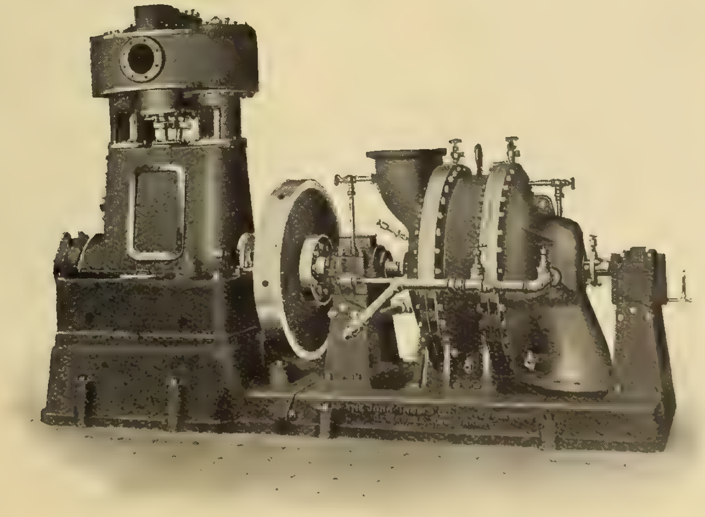

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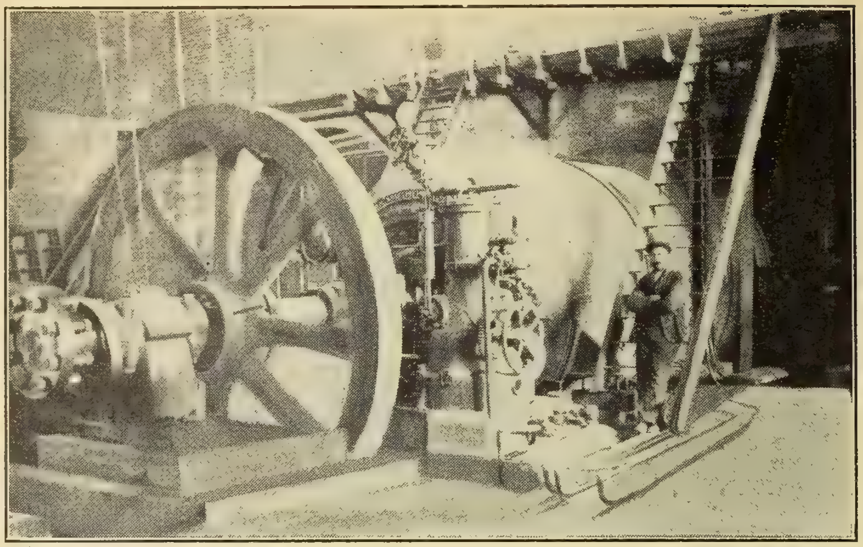

The illustration shows one of the two 3,750 B.H.P. Turbines and Oil Pressure Governor Supplied to the Calgary Power Co.

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Seven Different Sizes of Governors Made

Suitable for All Conditions

No Racks No Gears

Absolutely Self Contained

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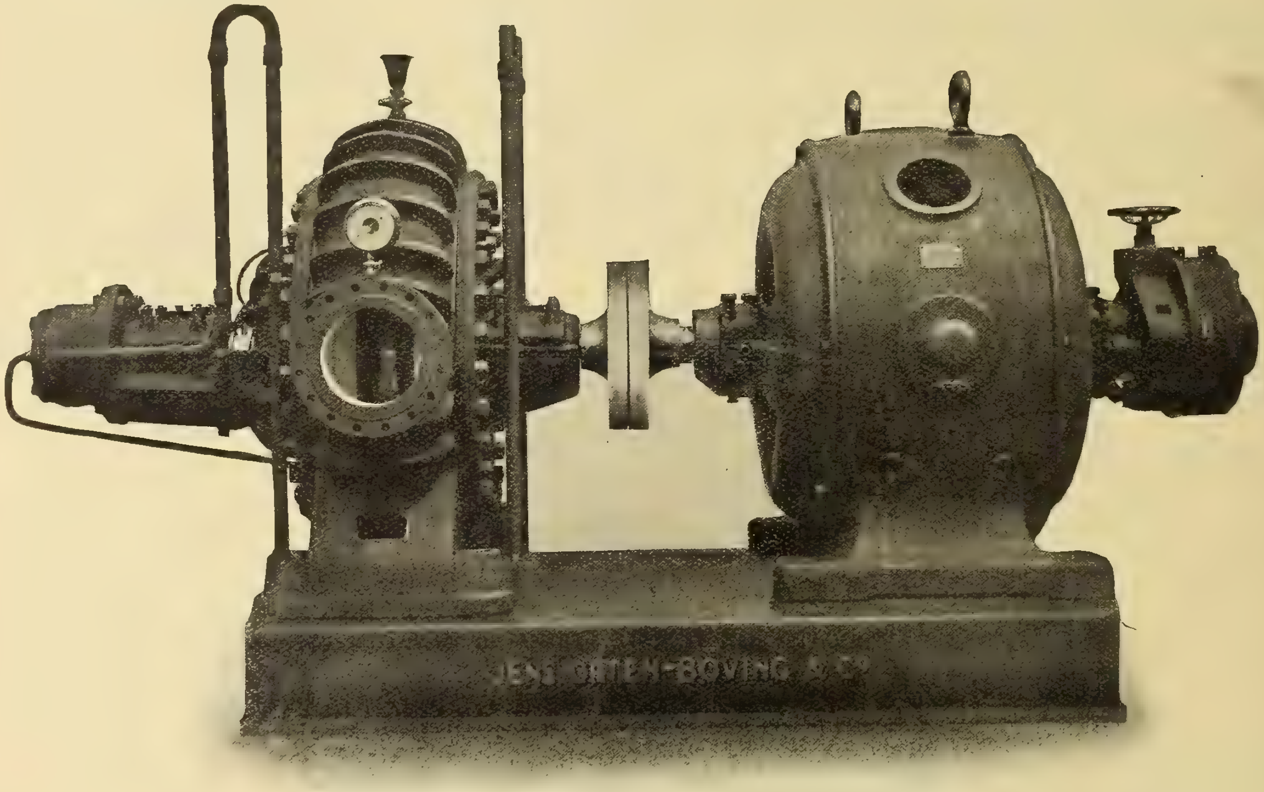

The pump illustrated was installed by the Nipissing Mining Co. for sluicing purposes. A hill of gravel and stones being sluiced off the rock by means of a high pressure jet produced by this pump.

HEAD 415 FEET—CAPACITY 4,000 IMP. GALS. PER MIN.—710 B.H.P.

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Made in all types and sizes from 1/2-in. to 2-in.

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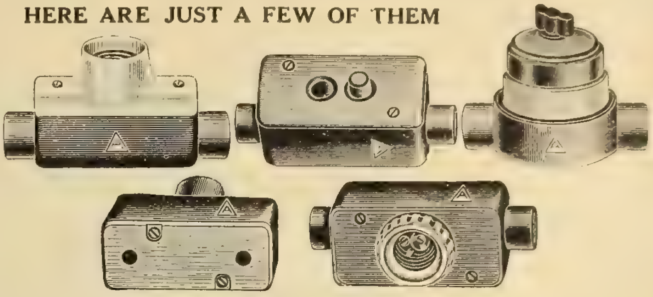

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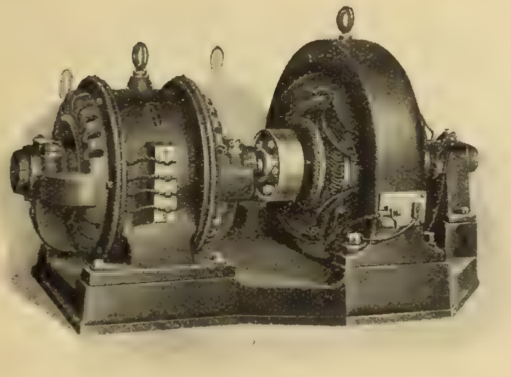

When in need of any special electrical apparatus or repairs to defective motors or generators, write us.

We are fully equipped.

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HAMILTON

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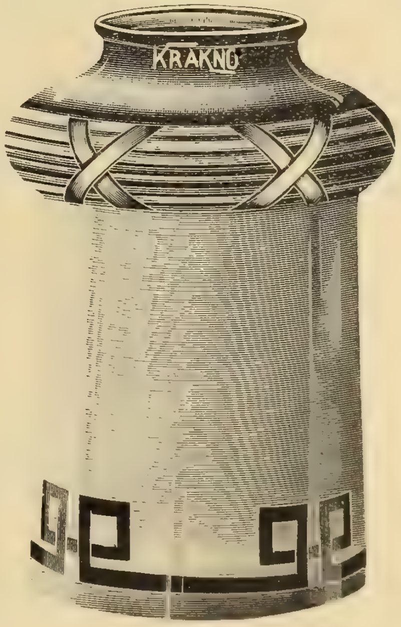

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It will pay you.

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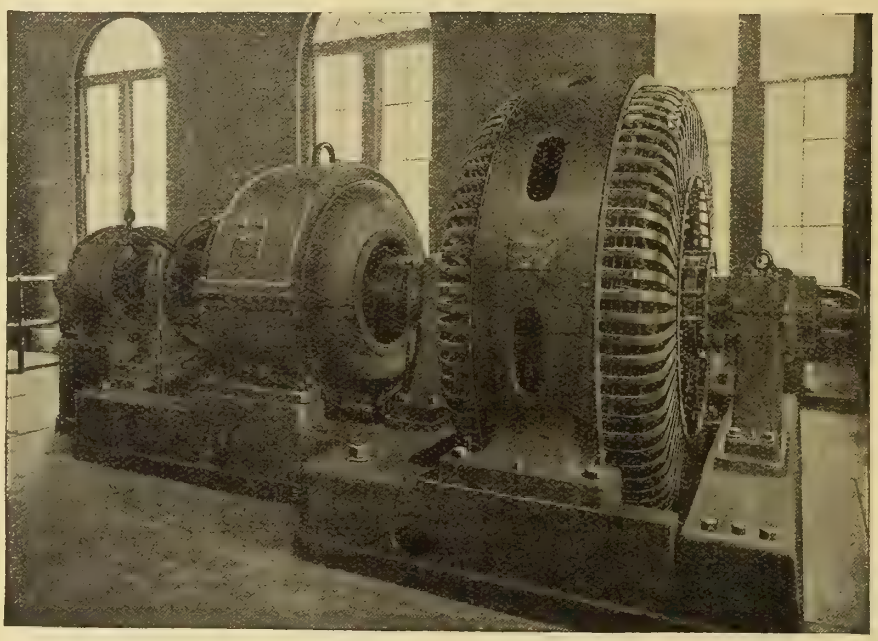
Westinghouse

Self-Starting Synchronous Motor-Generator Sets



Westinghouse Synchronous Motor-Generator Set with Direct Connected Exciter.
Motor, 1000 Kva. Generator, 400 Kw.

WHERE it is desirable to install an alternating-current motor-generator set, it is often advantageous to drive it with a synchronous motor.

Such a motor, in addition to driving the set, can be so arranged as to correct the power factor of the system that serves it, irrespective of whether the natural power factor of the system is leading or lagging.

The Best Service always follows the introduction of Westinghouse Apparatus

Canadian Westinghouse Co., Limited, Hamilton, Ontario

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Traders Bank Bldg.	52 Victoria Square	Ahearn & Soper, Ltd.	Telephone Bldg.	158 Portage Ave. E.	311 8th Ave. W.	Bank of Ottawa Bldg.

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1—20 h. p. 500 V. Westinghouse Electric Co.	Rebuilt
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1—160 light 125 Volt Westinghouse Generator with switchboard	Rebuilt
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AND REMEMBER We have the Best Equipped Repair Dept. in the Province.

The Electrical Maintenance & Repairs Co., Ltd.

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Long Distance Phones Adelaide 902-903

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Canadian Turbine Water Wheel

Normal in speed and discharge, giving the greatest range of high efficiency for working conditions.

Conserve the Water Powers.

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We can keep you running while we make your repairs.

Our repairs will keep you running satisfactorily afterwards.

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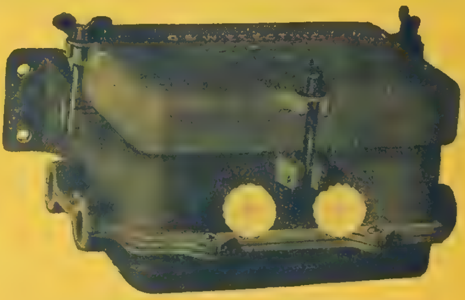
are the result of 15 years' demands of modern practice. They represent many new and original ideas by practical engineers.



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Cable submerged in compound.

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Detachable
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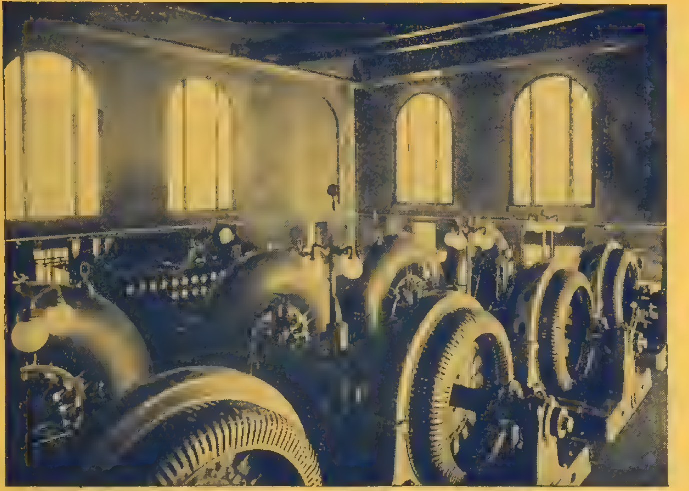
Vol. XXII—No. 2 Toronto, January 15, 1913

Electrical News

Generation, Transmission and Application of Electricity



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Turbines designed for heads from 5 feet to 600 feet.

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If your problem requires information based on a wide range of electrical manufacturing experience you will obtain this service through the co-operation of our nearest district office

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Light Your Curling and Skating Rinks

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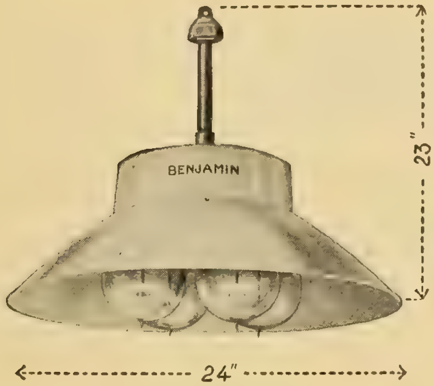
Benjamin Fixtures

FIXTURES—REFLECTORS—FITTINGS

for all indoor and outdoor requirements



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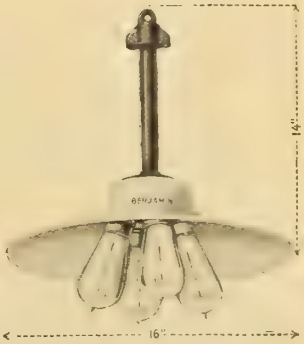

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will lay out a lighting system of

High Efficiency
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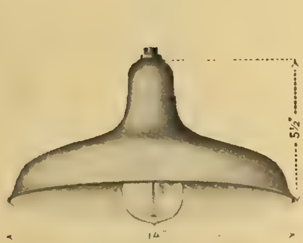

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TUNGSTEN LAMP

White and Bright as Daylight

Absolutely Without an Equal

Don't be satisfied if your dealer says "Here is something just as good"— There is nothing "Just as good as the NULITE."

Genuine Drawn-Wire-Continuous Filament

Ask For The Nulite

Made in Canada by

The Canadian Tungsten Lamp Company
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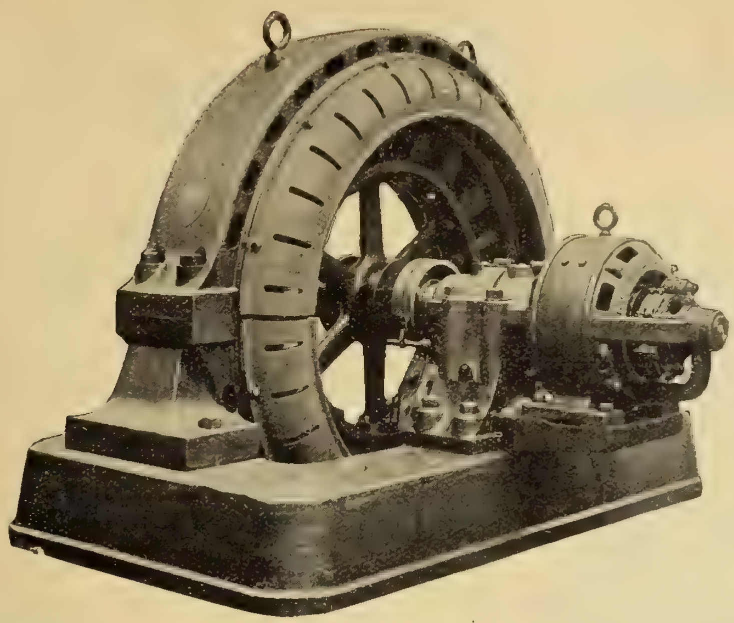

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CANADIAN AGENTS
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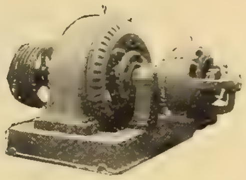

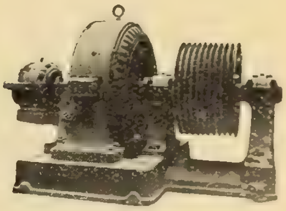

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on Tungsten lamps in case lots to the following cities:—Hamilton, Toronto, Peterboro, Ottawa, St. Catharines, Montreal, Quebec, Halifax, St. John, N. B., Winnipeg, Man.

Firms contracting for Tungsten and Carbon lamps should get our prices before closing contracts.

Fedram Wire Drawn Tungsten Lamps

are built to the most rigid specifications as to

Efficiency
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Prices and full information mailed on request

We can make you an attractive proposition on Tungsten and Carbon Lamps

Federal Engineering Co., Limited

TORONTO
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Flame Arc Lamps

LONG LIFE

New Type W

In construction work, railway yards, drill halls, warehouses, in fact everywhere where good, brilliant illumination is required over large areas this type of lamp is ideal.

The C.G.E. Flame Arc Lamps (Type W) are designed particularly for that purpose. The brilliancy of the widely diffused illumination from the lamp remains constant throughout its long electrode life.

The arc is steady and is always in the same focus from start to end of trim.

The electrode life is from 100-125 hours.

Trimming is very simple and only one carbon is renewed. Either a white or yellow light can be obtained as desired, depending on carbons.

The mechanism is simple and readily accessible. One noteworthy feature is the efficient clutch which is sensitive and positive in its action.

The casing is weatherproof and insect-tight. The C.G.E. Long Life Flame Arc Lamp is strongly and substantially built throughout. It is as reliable in operation as it is sturdy in construction. Send for full information regarding this economical and powerful lamp.

OVER 5000 NOW IN SERVICE

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The C. G. E. Ozonator

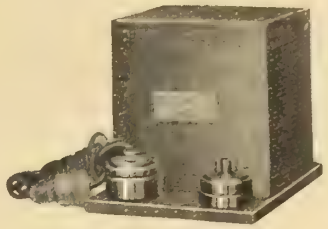
THE Ozonator is a device for destroying odours, poisons, infectious bacteria and purifying the air generally by Ozone produced electrically.

Hygienic conditions demand scientific sanitation and ventilation.

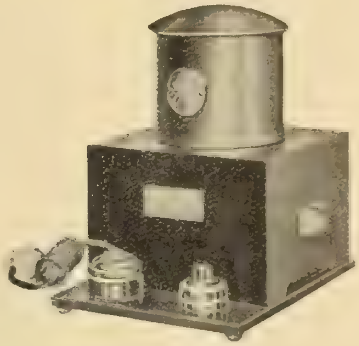
Ozone improves ventilation not by taking the place of fresh air but by destroying the foul and harmful organic substances that are ever present where people congregate. Ozone sterilizes the air and increases the activity of the oxygen component.

The C. G. E. Ozonator is used to great advantage and benefit in dwellings, halls, lodge-rooms, theatres, factories, etc. It is neat and compact, and can be attached to any electric light socket and consumes very little current.

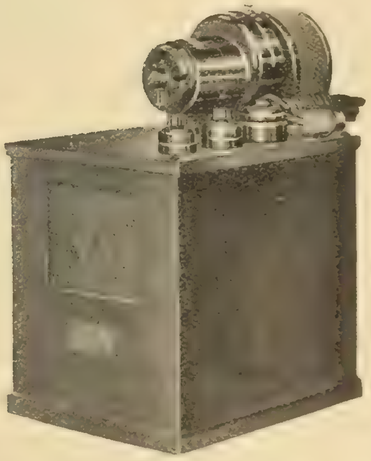
Write us for Booklet 506, giving further information regarding this new air purifying device.



UTILITY OZONATOR



HOUSEHOLD OZONATOR



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Canadian General Electric Co., Limited

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Every exacting engineer and architect is vitally interested in Conduits because the question of conduit protection is an absolute necessity in modern building and engineering practice.

We are prepared to submit convincing proof that **"GALVADUCT" and "LORICATED" Conduits** give longer life, better service, and more clearly meet the conditions for which they are made than any other conduits produced.

If your jobber cannot supply you, write us

Conduits Company Limited

Toronto and Montreal

SUNBEAM LAMPS

are made from material and
knowing how

No Guess Work

Sunbeam MAZDA Tungsten Carbon
and Gem Lamps have often been

Imitated But Never Equalled

The label is the guarantee of

QUALITY

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The Canadian Sunbeam Lamp Co.
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173 McDermott Avenue
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No. 7610
Reflector Bowl
Data book page S 2.5

MADE IN CANADA

The most efficient enclosing lighting Unit ever made

No. 8342
Realite
Data book pages S 2.7-2.9

No. 8310
Reflector Bowl
Data book page S 2.5

MADE IN CANADA

Artistic and beautiful with wonderful results

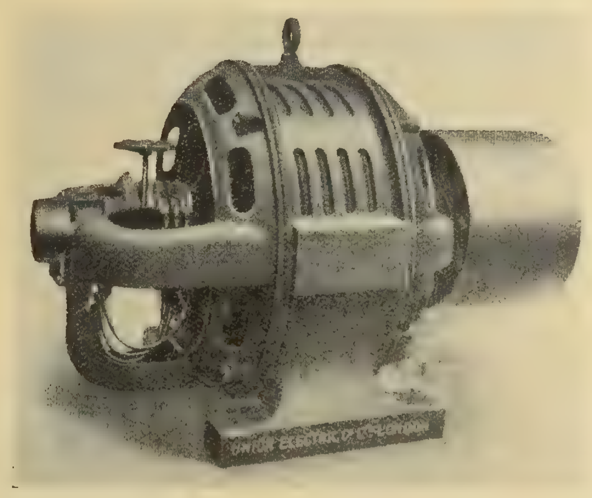
New Holophane Units for Large Interiors

THE HOLOPHANE CO., Ltd., Toronto

Makers and Distributors of
HOLOPHANE GLASS and STEEL. IRIS - VELURIA - CALLA - PYRO - Cut and Etched.

Union Polyphase Motors

and Motors of all kinds



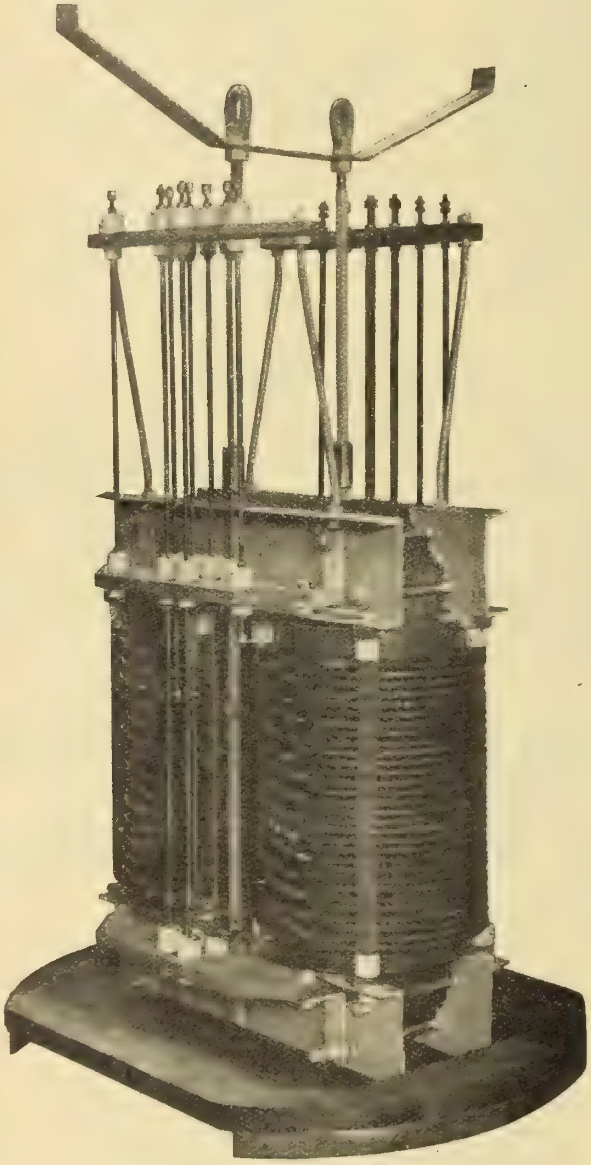
The best motor on the market to stand rough usage on heavy overload.

The highest efficiency obtained by the use of the best material and the most skilled labor.

Stocks carried in Montreal, Toronto and Winnipeg from which the trade can be supplied at the shortest notice.

Canadian Union Electric Co., Limited
122 Wellington St. W., Toronto　9 St. Nicholas St., Montreal
Mainer Electric Co., Limited, 61 Albert St., Winnipeg
Representatives for Manitoba, Saskatchewan and Alberta

Butt Joint
Core Type Transformers



350 K. W. Transformer

Note the arrangement for holding the core centred in the tank so that the transformer can be shipped complete in its case ready for immediate service.

Note also the strong mechanical arrangement of both H. V. and L. V. leads from coils to terminal board.

Note how easily the butt joint core type transformer is dismantled. The edges of punchings meet but do not overlap, and the top yoke can be quickly removed in case of injury to any of the coils.

Note the highly insulated H. V. coils so assembled as to expose the entire surface to the cooling oil.

WORKS - - - MONTREAL

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LIMITED

Sales Offices: MONTREAL, Canadian Express Co. Bldg. TORONTO, Traders Bank Bldg.
WINNIPEG Builders Exchange Bldg. VANCOUVER, Dominion Bldg.
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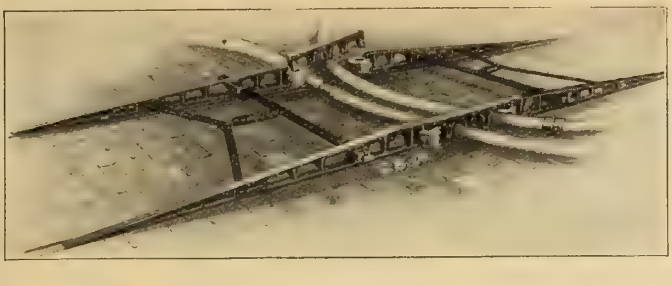


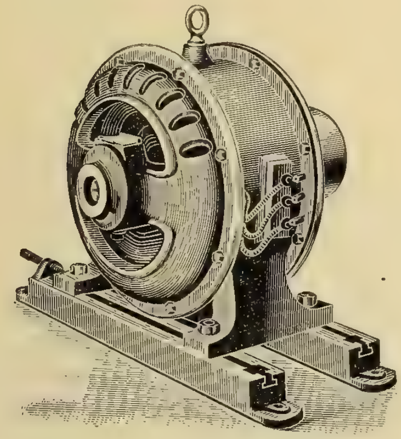
O-B Emergency Hose Bridge

Permits heaviest electric cars to pass over tracks crossed by fire hose.
Can you afford a blockade?

Page 901 of Catalog No. 12

THE OHIO BRASS CO., Mansfield, Ohio, U.S.A.

Use Good Motors
To Drive Your Factory



SUCH ARE MANUFACTURED BY

Toronto & Hamilton Electric Company
HAMILTON

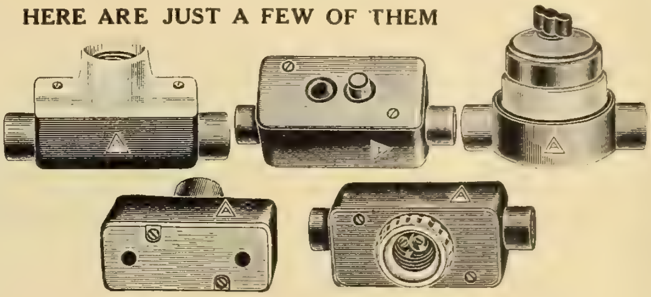
Have you any repairs? Write us

STEEL VS. CAST IRON
UNILETS
ONCE TRIED - ALWAYS USED

Because they are much lighter and stronger and at the same time giving more room in the box to do the work than is found in cast iron boxes. They are also very neat in appearance and are now used by the most exacting contractors throughout the land because they **make the job.**

Made in all types and sizes from 1/2-in. to 2-in.

HERE ARE JUST A FEW OF THEM



Send at once for copy of complete Catalogue

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APPLETON ELECTRIC CO.
212 North Jefferson St. - - CHICAGO, ILL.

FOR SALE BY
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Clermont Sewer Pipe Co.

Multiple and Single Duct Conduit for Underground Work

We challenge the world on finish and durability of our material. Our plant is located giving us the lowest freight rates to Canada.

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PACKARD METERS

For All Circuits

Always Reliable

Permanent Accuracy

Every Meter Guaranteed

TYPE PK POLYPHASE

Large Stocks at St. Catharines and Winnipeg St. John Railway Co., St. John, N.B.
General Supplies, Limited, Calgary, Alta.

The Packard Electric Company, Limited

Factory: ST. CATHARINES

General Sales Office
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TORONTO

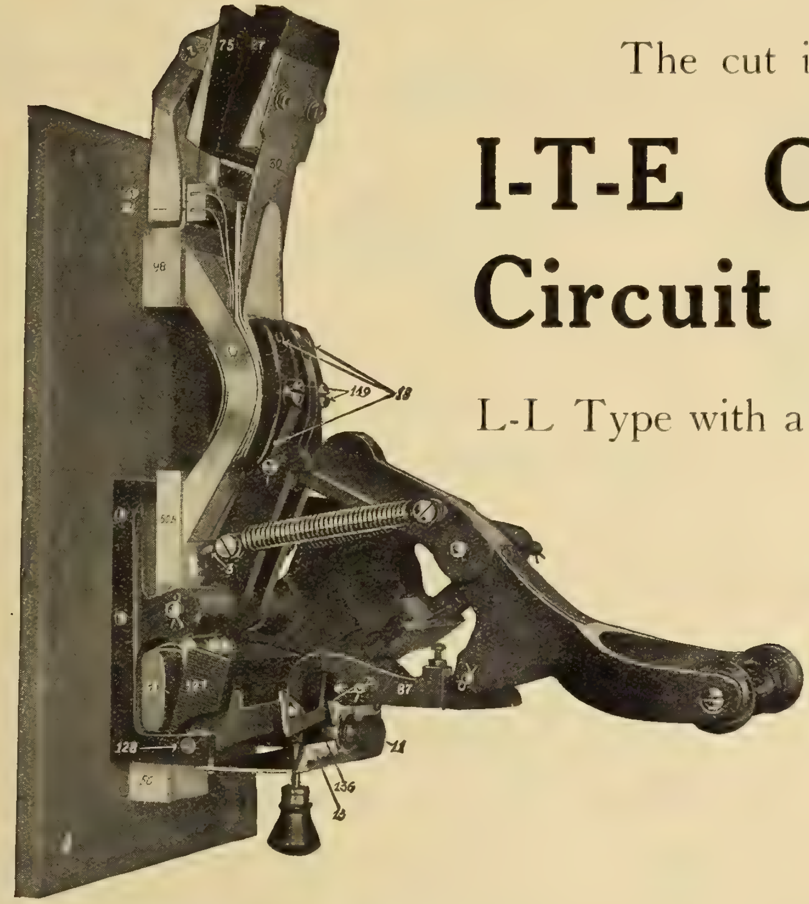
N. W. Office and Warehouse
WINNIPEG

Perhaps no one piece of electrical apparatus is more widely used than the I-T-E Circuit Breaker. Certainly none has a higher reputation for effectiveness and reliability.

The cut illustrates an

I-T-E Overload Circuit Breaker

L-L Type with a part of the housing removed, showing the admirable simplicity of the working parts.



For more detailed information as to this and other types of I-T-E Circuit Breakers see the new I-T-E CIRCUIT BREAKER HAND BOOK.

THE CUTTER COMPANY, Main Office and Factory PHILADELPHIA

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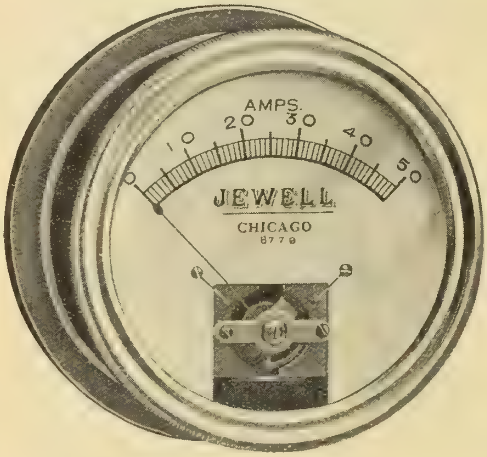
Eccles & Smith Co., 71 First Street, San Francisco, Cal.
Eccles & Smith Co., 524 S. Los Angeles St., Los Angeles, Cal.
Eccles & Smith Co., 68 First Street, Portland, Ore.
Electric Manufacturers' Sales Co., Tramway Bldg., Denver, Col.
I-T-E Electric Co., 72 Finsbury Pavement E.C., London, Eng.

MARSHALL-DAVIS
— LIMITED —
ELECTRICAL APPLIANCES
DUNNVILLE, - - ONTARIO

Agents for Jewel Electrical Company, Chicago



Precision Instruments
for
Switchboard, Laboratory,
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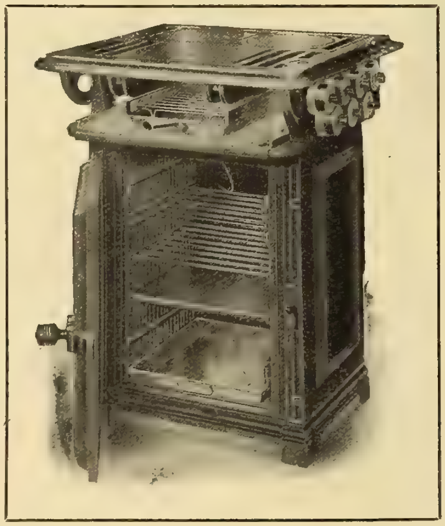
An Instrument for Every Purpose

PROMPT SHIPMENTS **BROAD GUARANTEE**



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ECLIPSE
Electric Heating and Cooking Utensils

The proved best appliances upon the British market.

Have been thoroughly tried out in actual use.

Are thoroughly reliable under usual kitchen conditions.

Highly efficient, well made and low in price.

Full information and particulars regarding complete range of apparatus upon application to

The Electric & Ordnance Accessories Company Limited
Works:
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Special Notice to the Trade

¶ Our Fall catalogue has been considerably delayed owing to the many new designs which we have been making. The printer promises same will be in our hands within the next few days, and we wil immediately begin distributing same.

¶ This catalogue will cover a very wide range of handsome and inexpensive fixtures, both of the direct and semi-indirect type. Included in same will be several designs using the ever popular effective candlestick to its best advantage. Also a nunber of fixtures adapting crystal decorations.

¶ We have not overlooked the use of leaded glass in Dining Room Domes, Hall Lanterns and several very handsome portables.

¶ We are very anxious that all the trade, as well as those interested in the better grade of fixtures, should receive this catalogue, therefore to be sure that you get a copy send us your name and address at once.

The Tungstolier Company
of Canada, Limited
HEAD OFFICE: **212 King St. West, TORONTO**

BANNER TRADE MARK

"Banner"
TRADE MARK

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Lighting Fixtures

Write to us for the latest designs in "up-to-date" electric fixtures.

Fixtures made from original drawings on short notice.

Ontario Lantern & Lamp Co., Limited,
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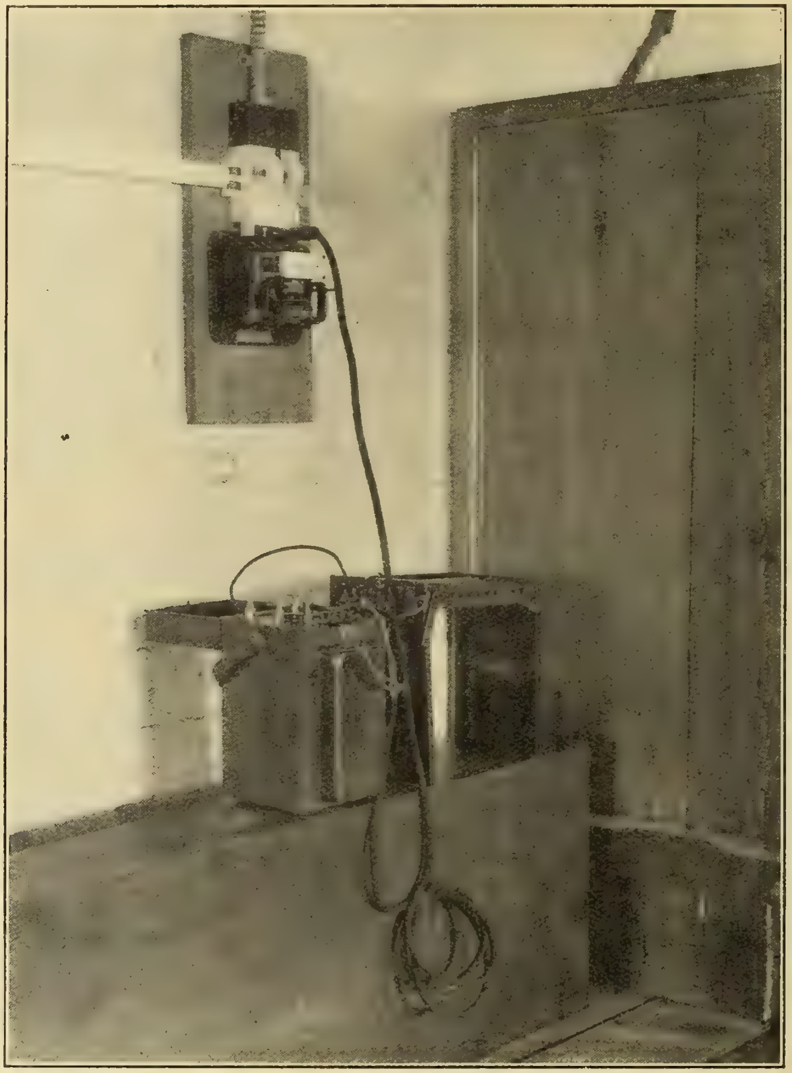
MURRAY PATENTS MURRAY PATENTS

METROPOLITAN Protective and Meter Testing Devices



View of General Electric type "I" induction watthour meter equipped with Metropolitan protective and meter-testing devices undergoing test. The portable testing plug is inserted in the cut-out, shunting the consumer's load during the test and at the same time making all of the necessary connections for the test of the meter by one single operation; thus the meter may be tested without the necessity of disturbing any of the connections or the interruption of service to the consumer.

Metropolitan Engineering Company

90 SHERBOURNE ST.
Toronto - - Canada

Announcement

WE have to announce that we have recently purchased the Stock in Trade of **THE JAMES STUART ELECTRIC CO.** of Winnipeg, Manitoba, and are carrying on this well known **Wholesale Electric Supply Business** at the old address, **324 Smith St.**

We shall at all times be glad to receive enquiries and calls from Engineers, Contractors, Retailers and others wanting to **BUY** Electrical Machinery, Electrical Supplies, Automobile Accessories, &c., or from Manufacturers Representatives who have anything good in Engineering Lines to **SELL.**

Our Warehouse and Showroom with its combined floor space area of over 15000 square feet enables us to carry a large variety of **STOCK,** and the position we occupy right in the **centre** of the principal city in the **centre** of Canada enables us to **DISTRIBUTE** Supplies both in the City of Winnipeg and in the Provinces of Manitoba, Saskatchewan and Alberta with the maximum of promptness and efficiency.

The Canadian British Engineering Co.
Limited

2 Toronto St.
TORONTO

324 Smith St.
WINNIPEG

Public Service Corporations

desiring to finance their needs by the sale of Bonds are requested to communicate with us.

We deal extensively in the bonds of Hydro-Electric Power Companies, Electric Railways, Gas Companies and Electric Lighting Companies which meet our requirements.

E. H. Rollins & Sons

Investment Bonds

200 Devonshire St.
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We Purchase Outright entire issues of bonds on steam and electric railroad, gas, electric and hydro-electric properties.

N. W. HARRIS & CO.

Established 1882
Incorporated 1911

35 Federal Street, Boston, U.S.A.

Our Telephones and Apparatus are Par-Excellent

Are Made for Good, Hard, Honest Service

They have withstood the **real test—Years of exacting service.** Our **Telephones represent the last word** in design and construction and are strong, durable and attractive. Furnished in all popular finishes.

Get our prices on Switchboards, Series Telephones, Bridging Telephones, Desk Telephones, Extension Bells, Magneto Bells, Transmitters, Receivers, Induction Coils, Condensers, Magnetos, Batteries, Plugs, Jacks, Drops, Lamps, and all kinds of Telephone, Switchboard and Exchange Equipment, including the most efficient protective apparatus on the market.

LET US KNOW YOUR REQUIREMENTS

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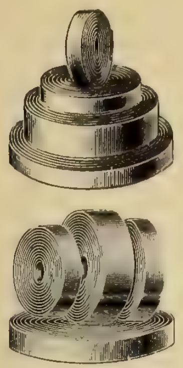
LAFAYETTE ELECTRIC & MFG. COMPANY

LAFAYETTE, INDIANA, U. S. A.



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Sheets in thickness from 0.1 to 1 mm. upwards.
Endless Rolls and Strips 0.1 to 1 mm. thickness.

BLACK PRESSPAN IN SHEETS, ROLLS AND STRIPS
Presspan Coils and Tubes for Transformers
Armatures, Discs and Shaped Articles.
VARNISHED PRESSPAN, MICA-COVERED PRESSPAN, &c., &c.

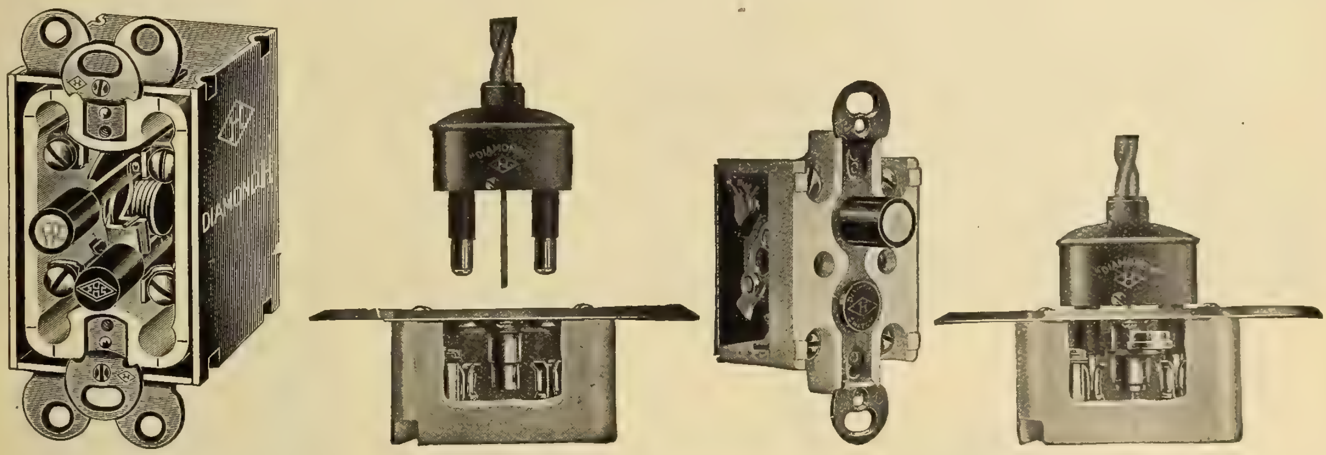
MICATENE—(Micanite)

in plates, hard and flexible
Micapapers, Mica clothes,
Mica insulating pieces.
Tubes for Generators and
Transformers in Cartogene
(insulating paper with
and without Mica)

Protect Your Investment in Switches by Specifying "Diamond H"

The best protection for the user because they are dependable in operation. The safest investment for the dealer, engineer or contractor because they give satisfaction.

The "Diamond H" on a switch is valuable insurance—assurance that quality, materials and competent workmanship are embodied to perfect production.



MANUFACTURED BY THE HART MANUFACTURING CO., HARTFORD, CONN.

Canadian Sales Agent

C. W. Bongard, Toronto, Canada

THE ORIGINAL
"WESTCOTT"
ADJUSTABLE "S" WRENCH

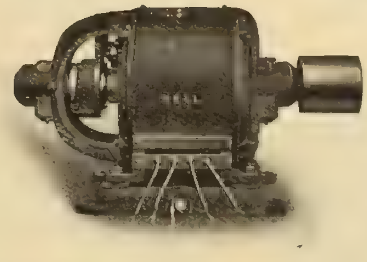
THE KEYSTONE MFG CO. BUFFALO N.Y.
WESTCOTT

HANDLE MALLEABLE IRON, JAW FORGED STEEL

We make also a Pipe Wrench
in this style

The Keystone Mfg. Co., 42 Chandler St., Buffalo, N.Y.

"BELL" **High Efficiency Single Phase Motors**



Meet All Requirements

Large stock carried throughout the country for immediate shipment.

Attractive Prices consistent with QUALITY

Our bulletin No. 138 which fully describes them will be sent to all interested

Bell Electric Motor Co., 30 Church treet, NEW YORK CITY
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Let us quote you prices. It will save you money.

Dawson & Company, Limited, Winnipeg
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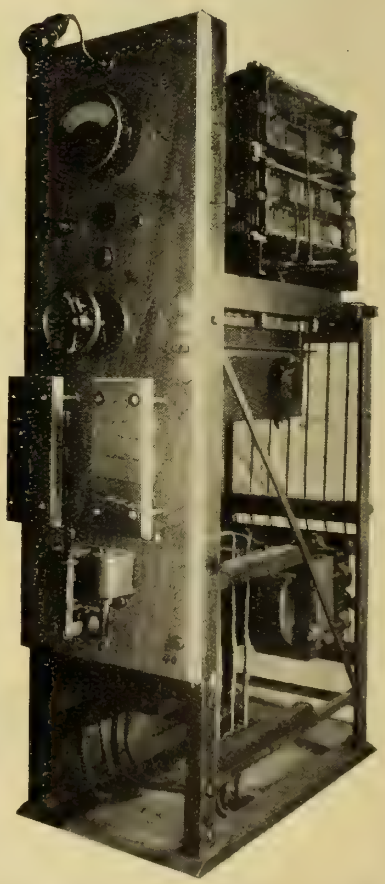
500 Amp. 6,000 Volt Automatic Oil Circuit Breaker Laminated Contacts Individual Oil Tanks. Can be equipped for remote control.

We manufacture

Electrical Specialties, Switchboards, Switches

Special Transformers

and numerous other Electrical Appliances but space prohibits enlargeing on them in this issue.



300 H.P. 2500 VOLT MOTOR STARTING EQUIPMENT

Northern Light Incandescent Lamps of Quality

We have just placed on the market a complete line of incandescent lamps under the trade name of *Northern Light*

These lamps are manufactured under our own Specifications and are subjected to the most rigid tests before leaving the factory. Each lamp must measure up to rated capacity of voltage, candle power and watts consumption.

These lamps are made with

Continuous Wire Drawn Mazda Filament **Carbon Filament** **Metalized Carbon Filament** and can be furnished in regular *Pear Shape*, *Round Bulb* and *Tubular* with *Standard Edison*, *Candelabra* or *Miniature Brand.*

Dealers are invited to write for our contract proposition covering their requirements

THE Northern-Electric AND MANUFACTURING CO. LIMITED

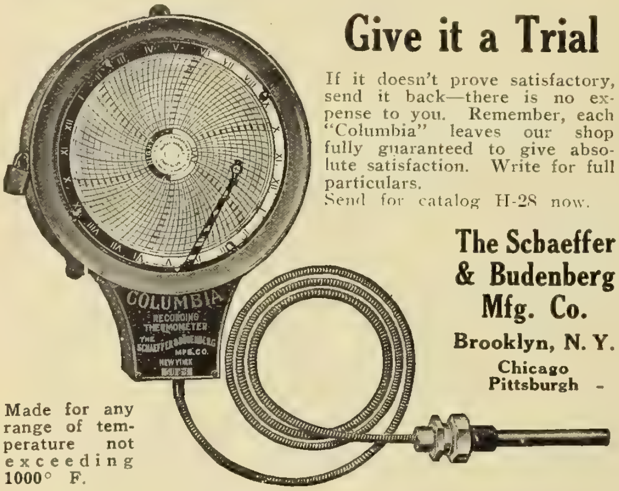
Manufacturer of Telephone and Fire Alarm Apparatus and Distributor of Electrical Supplies for every possible need

MONTREAL HALIFAX TORONTO WINNIPEG REGINA CALGARY EDMONTON VANCOUVER

The "Columbia" Recording Thermometer

is mercury actuated—let that sink in. For mercury, you know, is the best substance in existence for measuring temperatures. And to combine strength with accuracy the entire mechanism of the "Columbia" is made of steel, meaning long life. Pen arm is adjustable and recording pens are of glass, non-corrosive and non-spilling. Charts are uniformly graduated, have wide effective working range and the night and day border.

On the strength of these and many other exclusive features we feel justified in claiming the "Columbia" without an equal. But we don't ask you to believe us. Prove it for yourself—send us your order for a "Columbia."



Give it a Trial

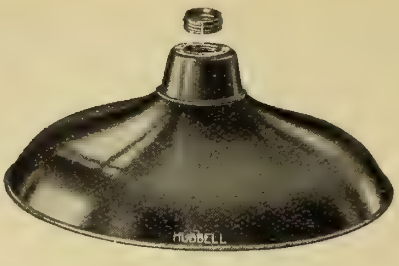
If it doesn't prove satisfactory, send it back—there is no expense to you. Remember, each "Columbia" leaves our shop fully guaranteed to give absolute satisfaction. Write for full particulars.

Send for catalog H-28 now.

The Schaeffer & Budenberg Mfg. Co.
Brooklyn, N. Y.
Chicago
Pittsburgh

Made for any range of temperature not exceeding 1000° F.

91



A Clear Road To The Money Fields

Continuous direct-to-consumer advertising of Hubbell Reflectors has opened the way to the money fields for hundreds of Dealers and Contractors. Don't be satisfied to sell lamps alone. Follow the trail of every lamp sale and sell

Hubbell Reflectors

Get after the factory trade. Factory owners want reflectors that are shaped right, priced right and above all **quality right.** They get what they want in Hubbell Tin, Brass, Aluminum and Steel Reflectors. This is a live line to tie up to.

Write for Free Advertising and Sales Helps

R. E. T. PRINGLE Mfrs. Agt.
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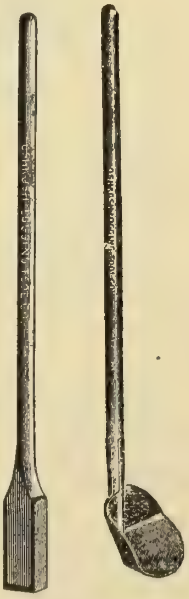
TRADE MARK
OSHKOSH
MEANS THE

Best Construction Tools

Increase the efficiency of your men by furnishing them the **Best** tools.

Send for Catalogue



Oshkosh Mfg., Co.
South Main
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The Lion M Tungsten Lamps

The Ideal Lamp for Business Premises

Strong, reliable manufacture, Long Life, More Light all the the time. Specially adapted for use in Offices, Stores and Factories.

TO THE TRADE

We are now ready to fill large or small orders from stock and make immediate deliveries and complete shipments.

Special prices and discounts on trade orders.

In lots of 1,000 and over, we etch on each lamp any name or mark required free of charge.

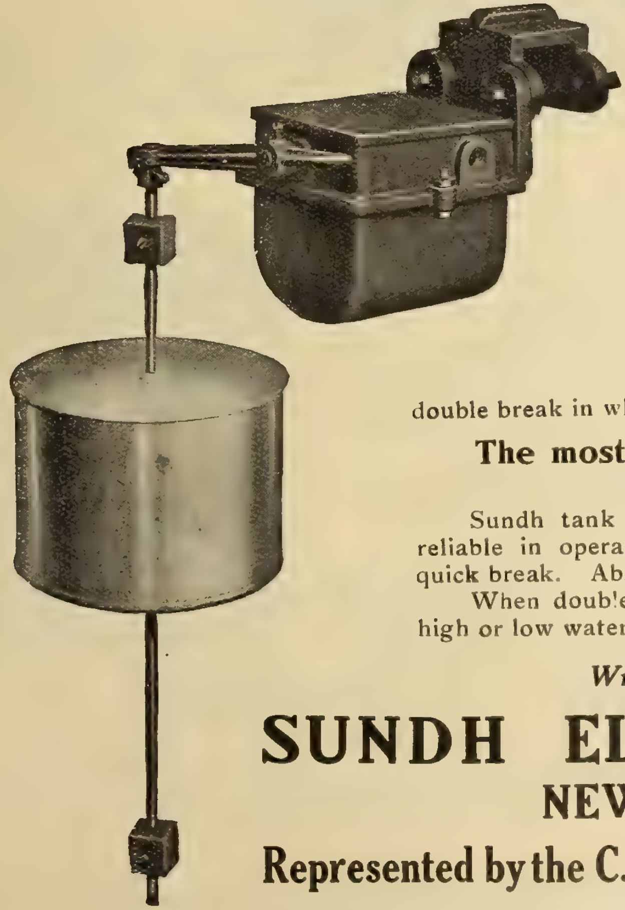
Samples submitted for testing.

Special quotations made on request - write us your requirements

Electrical Products Company, of Canada

28 Wellington St. West (Tel. Main 2298) Toronto

District Agents: EDMONTON—Miller & Miller HAMILTON—C. T. Inman, 95 Sanford Ave. N.



Sundh Tank and Sump Switches.

Rating

30 amperes normal capacity at 115 and 230 Volts A. C. or D. C.

15 amperes normal capacity at 440 Volts A. C.

15 amperes normal capacity at 550 volts A. C. or D. C., but switch should be made double break in which case use 2 pole piece.

The most serviceable switches produced for Controlling Water Levels

Sundh tank and sump switches are rugged in construction and reliable in operation. Have a snap action which unfailingly gives quick break. Absolutely weatherproof.

When double-acting, this type of switch forms the most reliable high or low water alarm on the market.

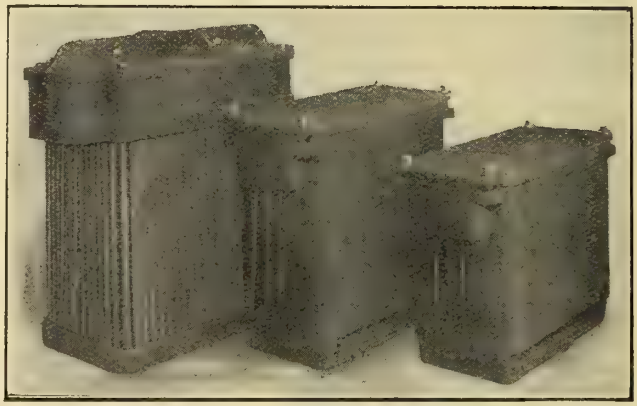
Write for catalog and prices

SUNDH ELECTRIC COMPANY

NEW YORK, U. S. A.

Represented by the C. H. L. Keeler Co., Ltd., Toronto, Canada

Operating and Construction Costs Reduced



Three Phase Pole or Station Transformers

PRACTICE has proved that three phase transformers are the most economical type to operate and the cheapest to erect. Of all three phase transformers the "Ferranti" is the leader and will deliver a higher percentage of your current than any other make.

All coils are wound with copper of ample sectional area, thereby reducing copper losses to a minimum. These coils are so connected that any out of balance load does not effect the regulating qualities of the transformer.

May we send you particulars?

The Ferranti Electrical Co. of Canada, Limited

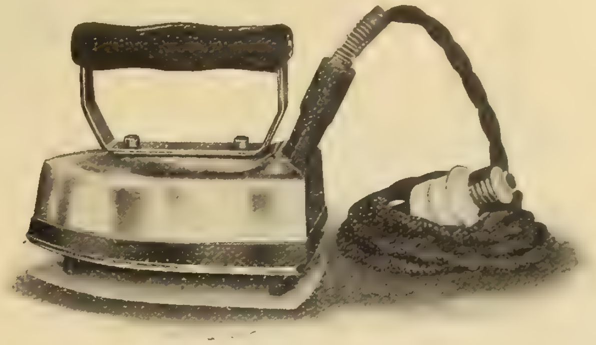
TORONTO, 90 Sherbourne St. **WINNIPEG, 56 Albert Street**

Royce Element

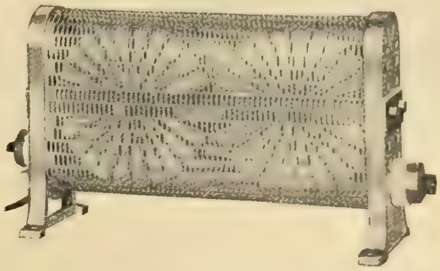
All "Economic" electric heating appliances are equipped with the Royce Indestructible Heating Element. Each of our electric appliances will stand 100% overload without burning out which means if operated on rated voltage they will **never** burn out.

In addition to the indestructibility of the Royce Element it is unusually economical to operate.

We illustrate the Economic Radiator and Iron, other Economic appliances include Disc Stoves, Water Urn Heaters, Tailors' Irons, Car Heaters, etc.



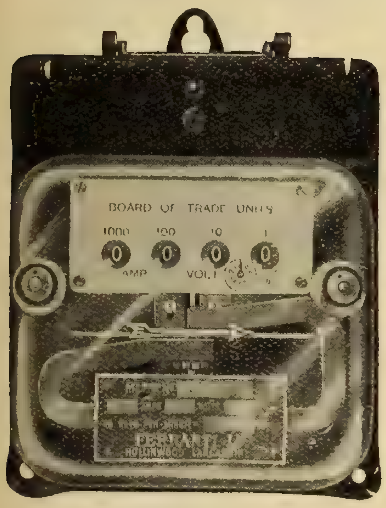
Royce Patent "Economic" Electric Iron



Royce Patent "Economic" Electric Radiator

The Ferranti Electrical Co. of Canada, Ltd.

FERRANTI METERS



Glass Case—Top Connections

Simplicity of construction.
Perfect accuracy.
Cyclometer or clock dials.
Top or bottom connections.
Prompt deliveries.

Every meter carefully inspected before shipment.

Absolutely guaranteed.

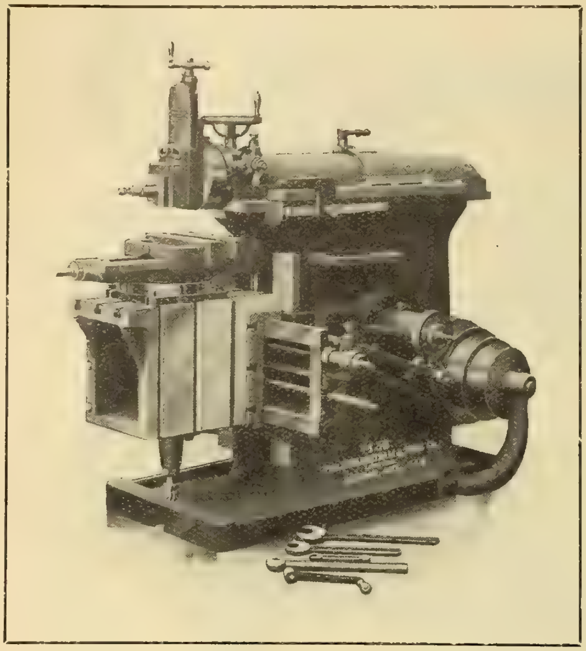
Send us your probable meter requirements and let us make you a proposition.

Large stock and fully equipped repair and erection Shops at Toronto and Winnipeg.

Steel Case—Top or Bottom Connections

The Ferranti Electrical Co. of Canada, Ltd.

TORONTO **WINNIPEG**



Bertram Shapers

The illustration shows our 24 inch Back Geared Crank Shaping Machine, with Extended Base, Power Down Feed to Head and Outer Support to Table.

Immediate shipment from stock.

We can supply this machine motor driven.

The JOHN BERTRAM & SONS CO., Limited

DUNDAS, Ontario, Canada

Sales Agents: The Canadian Fairbanks-Morse Company, Limited

E.E.E.CO. CHICAGO ILL PAT APD FOR NO 50
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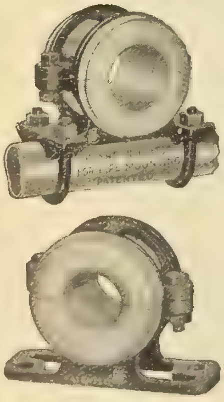


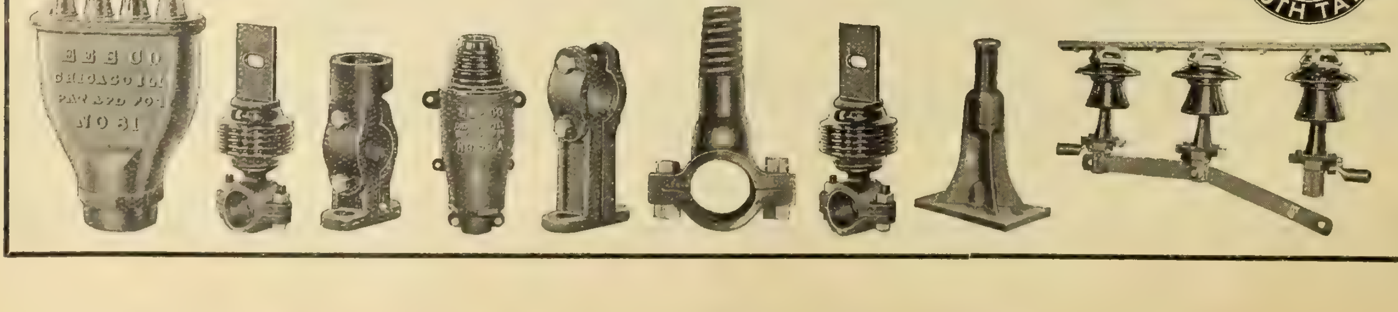
HUNDREDS of distribution problems have taught us the importance of little things—things that even you might be pardoned for overlooking.

That is why you will find it most satisfactory to use our Cable Bells, Potheads and Cable Terminals.

Write for our big blue catalog.

Electrical Engineers Equipment Co.

10-12 N. Desplaines St., Chicago, Ill.



Electrical News
Generation, Transmission and Application of Electricity

PUBLISHED SEMI-MONTHLY BY
HUGH C. MacLEAN, LIMITED,
HUGH C. MacLEAN, Winnipeg, President.
THOMAS S. YOUNG, General Manager.
HEAD OFFICE - - 220 King Street West, TORONTO
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MONTREAL - Telephone Main 2299 - 119 Board of Trade
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The "ELECTRICAL NEWS" will be mailed to subscribers in Canada and Great Britain, post free, for $2.00 per annum. United States and foreign, $2.50. Remit by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Vol. 22 **Toronto, January 15, 1913** **No. 2**

The Working Out of the Hydro Plans

In accordance with powers granted at the last session of the local legislature, the Hydro-electric Power Commission of Ontario are gradually rounding into shape their comprehensive scheme of systematic control of the operations in the various municipalities served. This is true not only with regard to standardization of equipment and methods of installation, but also with reference to the rates levied for the different forms of light and power. This is a matter of extreme importance in the successful working out of this great undertaking and promises to remove one of the greatest and most universal enemies to the successful operation of municipal enterprises, viz., local politics. The need for such a move is all too apparent in certain quarters—profits in certain departments were being used to cover deficits in other departments or to reduce the general taxation rate; under the lash of competition, light and power was being sold below cost; street lighting was being charged at an unduly high rate, and finally the year-end promise of advocacy of cheaper rates, regardless of cost or consequences, was made the excuse for an appeal for the poor man's vote. These conditions were not rampant, fortunately, but their existence will not be questioned.

The course taken by the Commission to remedy these evils has been businesslike and systematic. Some months ago a uniform system of accounting was drawn up and arrangements made whereby every municipality could keep itself and the Commission in touch with expenditures and receipts in the various sub-departments of house lighting, street lighting, commercial lighting, power, etc., according to standardized rules. Periodically each municipality now makes a report to the Commission with the result that that body is in a position to ascertain at a glance the condition of any sub-department of any municipality's operations. To render this system of account keeping absolutely uniform, it was necessary that the method of charging should also be standardized and this is now the case.

The natural sequence to the working out of this accounting system is the control of rates and their scientific and frequent adjustment by the Commission—natural for two reasons. First—the officers of the Commission being entirely removed from the scene of local strife should have no object in treating each individual case other than on its own merits. Second—the Commission is able to maintain a staff of skilled engineers and accountants quite beyond the reach of the ordinary municipality. Each municipality therefore, however small, reaps the benefit of the experience and advice of men of recognized reliability and skill.

The municipalities are quickly recognizing the advantages of such a well-balanced system and while there may have been, in isolated cases, a slight tendency to resentment at what may seem like depriving them of the management of their own affairs, this feeling is giving place to satisfaction in the recognition that each municipality's business is being better managed, and at less cost, than they could hope to do it themselves.

Electrification of Steam Roads

In this issue we print an article by Mr. N. W. Storer on the subject of electrification of steam roads. In view of the conditions existing in Canada at the present time, where plans are even now under discussion for changing from steam to electric operation, a paper of this kind is timely and valuable. The paper points out that it would be a great mistake to move too rapidly in the matter of the electrification of steam roads. The competition which electricity has introduced has roused the steam roads to special activity, with the result that marked improvements in operative conditions and in operation costs have been introduced in steam locomotives. As a result, the advantages claimed formerly for the electric locomotives are not so evident. The author further states that electric locomotive design is as yet more or less in the formative stage and has not reached that state of perfection that electric cars or other electrical equipments show. Mr. Storer takes advantage of the occasion to describe the different types of locomotives as to their design and various forms of drive, pointing out the advantages and disadvantages of each. It is made abundantly clear that varying conditions must regulate the design of the electric locomotive to a great extent if best results are to be obtained. It is necessary that each locomotive should be designed for its special requirements. Where the requirements are variable it follows that the efficiency of the electric equipment will not be so great.

Nor is the design of the locomotive the main consideration. Conditions of current supply, the location of sub-stations, the quantity of current to be used, depending on the size of the locomotive and the loads to be carried, are factors of prime importance in the determination of the cost of electrification. On account of the heavy current requirements, sub-stations must be frequent and the feeder system capable of carrying requirements for heavy service. It is calculated that 3,500 volts d.c. is the lowest possible for satisfactory service on heavy locomotives; this, on account of the heavy current requirements which would make the cost of lower voltage equipment prohibitive. This voltage is not yet a commercial possibility as far as locomotive equipment is concerned. A brief review is given in the paper of a number of high voltage single-phase systems which are operating satisfactorily as high as 15,000 volts.

Cedars Rapids Equipment

As stated in our last issue, the Cedars Rapids Manufacturing and Power Company have closed a contract for the supply of twelve 10,800 horse power turbine units. These will operate under a head of thirty feet at a speed of 56 revolutions. The equipment will also include three 1,500 horse power exciter units for the same head, the speed of these being 150 revolutions per minute.

The design of these turbines will be very similar to that of the Keokuk plant, described in the September number of the Electrical News, the only real difference being that the weight of the rotor of the generator and of the revolving parts of the turbine will be carried on a thrust bearing above the generator instead of below, as is the case in the Mississippi plant.

This contract has been divided between the I. P. Morris Company, of Philadelphia, and the Wellman-Seaver-Morgan Company, of Cleveland. The I. P. Morris Company's contract covers the design, construction and installation of nine of the main units, the three exciter units and also the twelve main unit and three exciter unit governors with complete pump auxiliaries. The Wellman-Seaver-Morgan Company will construct three of the main units from the same design.

The water-wheel contract includes the turbine complete, the shaft running through the turbine and generator, the thrust bearing support or truss to be located above the generator, also the thrust bearing complete. The weight of the generator will be taken through cast iron supporting barrels through the turbine to the foundation below.

The main units will be of the single runner vertical shaft type and will be installed in wheel chambers of spiral shape formed in the concrete foundations of the power house. These water wheels will be the largest in size in the world. The exciters will be of the same type only smaller in size. The runners for these wheels will be an enlargement of a model runner which under test at Holyoke gave an efficiency of ninety per cent.

Mr. Nicholls is President

At a recent meeting of the directors of the Canadian General Electric Company, Mr. Frederic Nicholls, general manager and vice-president of the company, was elected president. Mr. W. R. Brock, the former president, was elected to the office of honorary president.

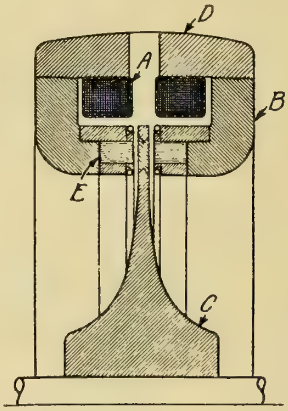
For more than a quarter of a century the Canadian General Electric Company and Frederic Nicholls have been synonymous terms. The tremendous growth of the company, financially, is shown by the latest annual report dated April 30, 1912, which places the assets at the enormous total of $15,522,253. This, compared with the original modest $10,000 capitalization less than thirty years ago, is indicative of the indomitable energy and splendid executive ability Mr. Nicholls has brought to his company's service through all these years. The success of the products of the company has been no less marked, for the C. G. E. trade mark on any piece of electrical equipment is recognized as standard the world over.

Single-Phase Motor, Pole-changing Windings

A new type of single-phase commutator motor recently installed in the James Watt Engineering Laboratories of the University of Glasgow was inspected by the members of the Institution of Electrical Engineers on the occasion of their recent visit to Scotland. The motor is described in a recent paper by Messrs. Nicholson & Haigh, read before the Institution. This motor, which is the invention of one of the authors, is intended for railway service, although the particular machine tested is only of small size and of open construction suitable for experimental work. The main difference between this type of machine and other commutator motors lies in the use of pole-changing windings.

Generating Apparatus for Wireless

The advance in high frequency generating apparatus for wireless telegraph and telephone work has now reached a point which a few years ago would have been considered an impossibility. Up to 1908 the highest frequency that had been produced was 10,000 cycles, but in that year Mr. E. F. W. Alexanderson, of the Consulting Engineering Department of the General Electric Company, produced an alternator built for 100,000 cycles. Mr. Alexanderson has now published details of a machine capable of generating with a frequency of 200,000 cycles, and a frequency of 400,000 cycles has been produced by the use of this same machine in combination with a mercury arc rectifier.



Section high-frequency alternator

The standard 100,000 cycle alternator has 600 slots, and consequently the same type of winding for 200,000 cycles would require 1,200 slots. A new type of winding was devised which allows the use of two-thirds as many slots as the effective number of poles, so that in the 200,000 cycle machine 800 slots are employed. The alternator is of the induction type and is provided with a novel arrangement of the magnetic circuit allowing the construction of a rotor which can be operated at exceedingly high speeds. A semi-cross section parallel with the axis of this high frequency alternator is shown in the accompanying figure. The rotor, C, consists of a steel disk with thin rim and wide hub, shaped for maximum strength. The field excitation is provided by two coils, A, located concentric with the disk and creating a flux that passes through the cast iron frame, D, the laminated armature with its teeth and the disk. B represents the two armatures which are secured in the frame by means of a thread in order to allow adjustment of the air-gap, and the laminations carrying the conductors are located at E. Instead of poles or teeth the disk C is provided with slots which are milled through the thin rim so as to leave spokes of steel between the slots. The slots are filled with a non-magnetic material which is rivetted solidly in place in order to stand the centrifugal force and to provide a smooth surface on the disk so as to reduce air friction.

Mr. Alexanderson points out that although the present phase of the wireless art refers almost exclusively to telegraphy conducted by the spark method using 500 cycle generators, there are many reasons which lead to the belief that this type of wireless outfit will in the near future be superseded by the system in which a continuous train of waves is used generated by high frequency alternators.

Yarmouth Light & Power Co.

The Yarmouth Light and Power Company, Limited, was recently incorporated taking over the Yarmouth Electric Co. and the Yarmouth Street Railway Co. Since re-organization this company have relaid two miles of old track and put down a quarter mile of new, with 60 pound rails and tamarac ties, extending the line southward over Church Hill and tapping a fairly thickly settled section of the town. They have strung one and a half miles of new trolley wire and renewed the poles along the line, and with the addition of three new cars, have a thoroughly efficient and up-to-date service, operating two and a quarter miles in the winter and nearly three and a half miles in the summer when the park at Lakeside is opened.

A contract has been entered into with the town, whereby for the term of ten years, this company will light the streets, operate the fire alarm system and pump the water, at an annual charge of $8,500. To light the streets under the terms of the contract it has been necessary to erect many poles, arrange new circuits and install lights. This work is under way and will be completed in a few weeks. The prospect for furnishing power to industrial and other plants is very encouraging at present, and several contracts have been entered into, while others are in process of negotiation.

The hydraulic power plant at Carleton, capable of supplying 500 h.p., and the installation of new generating equipment in connection with the auxiliary steam plant in town, which will give the latter a capacity of 450 h.p., indicates the company is well equipped to meet all present needs, and reasonable future expansions. A 22,000 volt, 3 phase, transmission line 18 miles long connects the hydraulic plant at Carleton with the sub-station in town.

The directors of the Yarmouth Light and Power Company are: Willard M. Kelley, president; Edgar K. Spinney, vice-president; John T. Murphy, W. H. Covert, Blake G. Burrill, and C. C. Richards. Mr. John T. Murphy of Halifax, is managing director. Mr. James Graham, formerly of the Canadian General Electric Company at Halifax, is resident manager and general superintendent.

Two-Speed A.C. Motor for Fan Drive

The Westinghouse company have recently brought out a two-speed a.c. motor specially designed for operating ventilating fans in mines. Under average circumstances the number of miners at work during the night is considerably less than during the day time, resulting in a smaller fresh air requirement. The type of machine being used in this particular case is a squirrel cage induction motor with a rating of 7½ horse power at 600 r.p.m. and 15 horse power at 1,200 r.p.m. The change in speed is accomplished by changing the number of poles. The stator of the motor is provided with two windings, one of which gives 6 poles resulting in a speed of 1,200 r.p.m., and the other gives 12 poles with a speed of 600 r.p.m. The connections are changed from one side of the windings to the other by the controller.

Tests made on the operation of this motor by the electrical engineer of the company for which it has been installed, show that this equipment has a practically constant efficiency under both these circumstances. The fan is 5 ft. 6 in. wide with a blade depth of 3 ft. 6 in. When running at 120 r.p.m. with an air pressure difference of .87 oz. per sq. in., 46,200 cu. ft. of air per minute were delivered, and the motor took 9.6 kilowatts, giving an efficiency of 63.03 per cent. for the outfit. When running at half speed or 60 r.p.m., with .29 oz. pressure difference per square inch, 14,850 cu. ft. per minute were delivered and an efficiency of 58.33 per cent. was obtained.

Resuscitation from Electric Shock

The subject of "Resuscitation" is so important that at the risk of repeating ourselves we publish below some extracts from a recent address by Dr. C. A. Lauffer, Westinghouse medical director. Dr. Lauffer advocates the Schaeffer method which is at the same time both simple and effective,—

A working knowledge of a good method of artificial respiration is essential in every walk of life, and no man can predict whether or not his failure to learn some method may any day be responsible for loss of life. The essential features of the Schaeffer method are (1) the Position of the patient; (2) Posture of the operator; (3) The mode of operation; (4) Rate per minute and duration of operation.

The Position of the Patient

The man is laid upon his stomach, face turned to one side, so that the mouth and nose do not touch the ground. The subject's arms are extended above his head. This position causes the tongue to fall forward of its own weight and so prevents its falling back into the air passage. This fact makes it possible for one man, alone and unassisted, to save the life of a comrade in electric shock or other conditions requiring artificial respiration. Turning the head to one side also prevents the head coming in contact with water or mud during the operation; there is no time for removal of the body to another place,—the resuscitation must be begun the instant the body is recovered from the circuit, even though other places in the neighborhood may be cleaner. This position of the subject, further, facilitates the removal of any foreign body from the mouth—tobacco, chewing gum, false teeth, &c., and favors the removal of mucus, blood, vomitus, serum—any liquid that may be in the mouth, or obstructing the air passages.

Posture of the Operator

The operator kneels, straddling the patient's thighs, or kneels by either side of the thighs, facing the patient's head. The operator feels with both hands the bony landmarks of the patient, the prominent bones of the pelvis, the muscles of the small of the back, and the floating ribs. With the lowest ribs located, the operator places his spread hands, with thumb nearly parallel to fingers, so that the little finger curls over the end of the twelfth rib, and the heel of the hand rests near the ends of the lowest ribs; the hands are well removed from the spine, and the fingers are nearly out of sight. This affords maximum leverage on the floating ribs, and correspondingly reduces the muscular exertion required on the part of the operator.

The Mode of Operation

The operator's arms are held straight, and his weight is brought from his shoulders by bringing his body and shoulders forward. This weight is gradually increased until at the end of the three seconds of vertical pressure upon the lower ribs of the patient, the force is felt to be heavy enough to compress the parts; then the weight is suddenly removed. The hands may be entirely removed, or, if there is danger of not returning them to the right position again, merely the pressure may be entirely remitted. Shirt and other clothing should be town off, and the operator's hands should be on the bare back of the patient.

Rate per Minute, and Duration of Operation

The natural rate of breathing is twelve to fifteen times per minute; the rate of operation should not exceed this. The lungs must be thoroughly emptied by three seconds of pressure, then their refilling takes care of itself. Pressure and release of pressure—one complete respiration—occupies about five seconds. If the operator is alone, he can be guided in each act by his own deep respiration, or by counting, or by his watch lying by his side. If comrades are present, he can be advised by them.

The duration of the efforts at artificial respiration should ordinarily exceed an hour; indefinitely longer if there are any evidences of returning animation by way of breathing, speaking, or movements. There are liable to be evidences of life within twenty-five minutes in patients who will recover from electric shock, but where there is doubt, the victim should have the benefit of the doubt. In drowning especially, recoveries are on record after two hours or more of unconsciousness; hence, this method, being easy of operation, is more liable to be persisted in. The physician on his arrival can determine if there is any heart action. The pulse at the wrist may stop, and the heart still be beating,—a condition calling for continuous rythmic efforts at resuscitation, combined with medication.

Auto-Synchronous Motors

The use of the synchronous motor for industrial purposes is rapidly increasing. This is due chiefly to the necessity of improving the power-factor on large alternating current systems where the load is made up to a great extent of induction motors of various sizes, a great many of which are not usually loaded to full capacity.

The ordinary synchronous motor, however, has several disadvantages, one of which is that it is necessary to have some method of bringing the rotor up to speed before it can be thrown on the line to carry its full load. This must be accomplished either by a separate starting motor or by a short-circuited winding arranged around the periphery of the revolving field, the latter method being usually adopted in America. Both these methods however, have the great disadvantage that they only permit of the motor being started on a small percentage of the normal full load. The synchronous motor has the further disadvantage that if it is subjected suddenly to a severe over-load, or if the voltage drops suddenly due to a disturbance on the line, the rotor will drop out of phase and stop dead and a delay of five or ten minutes will be caused before the motor can be started up again. This, in a great many cases may cause a serious inconvenience to the user.

A type of synchronous machine that has been named the auto-synchronous motor was designed and patented some years ago by the Swedish General Electric Company with the object of combining the advantages of the induction motor with those of the synchronous motor and at the same time of eliminating the objections referred to above. The design of the machine is similar in practically every respect to that of the ordinary slip-ring type induction motor with the exception that a specially designed three-phase rotor winding is used. This, on account of its low resistance, is suitable for connection to a low voltage field current. A specially designed low voltage exciter is necessary on account of the low resistance of the rotor circuit. This exciter is usually direct-connected to the motor shaft and often is series wound as this construction eliminates the use of a field rheostat, the exciter voltage being varied by means of moving the brushes. The exciter voltage varies from fifteen to thirty volts depending on the design of the motors. Machines of this type are manufactured in all sizes up to 1500 h.p. On account of the heavy field current that would be required for excitation due to the low voltage used, this type of motor has not been manufactured in any larger capacities.

Method of Operation

The motor is started up as an ordinary slip-ring type induction motor; that is, by closing the primary switch which leads the three phase current from the line into the stator, (a resistance being inserted in the rotor circuit), and by gradually cutting out resistance in the rotor circuit until on the last contact of the starting resistance the rotor will be short circuited and the motor will be operating as near synchronism as possible. In this way the motor can be started up with as much as twice the full load torque. When the motor has obtained full speed, the starter is cut out of circuit by means of a three-pole double-throw switch, and at the same time direct current from the exciter is fed into the rotor. In the accompanying figure it will be seen that the motor under starting conditions is similar, in theory, to an ordinary three phase transformer with a high resistance inserted in the secondary, A, B, & C being the three phases of the secondary winding. As the resistance is being gradually cut out the current in this winding will increase in value until at the last contact point all resistance is cut out and direct current from the exciter is simultaneously fed into the secondaries, two of which are now automatically connected in parallel so that the current will enter the rotor by (say) the wire A, and leave it by both the wires B & C. The windings A, B & C are so adjusted that the resistance of B & C combined exactly equals that of A. As direct current is introduced into the rotor the motor will drop into synchronism and operate as an ordinary synchronous motor. The exciting current can then be adjusted to obtain any desired power-factor correction until the full capacity of the motor is being utilized.

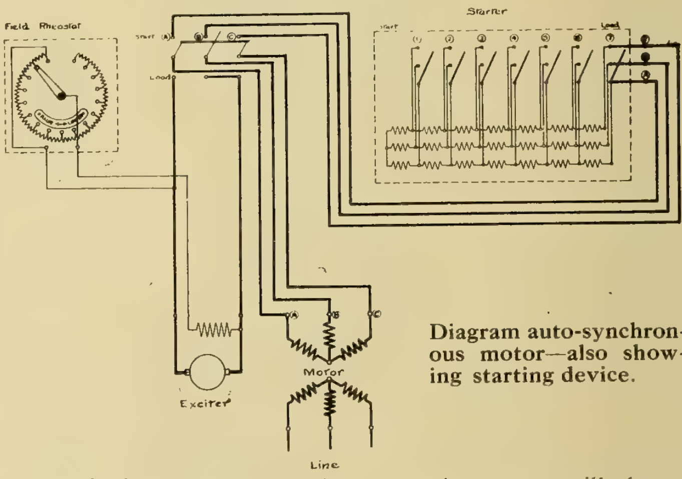


Diagram auto-synchronous motor—also showing starting device.

Supposing now that a heavy short circuit on the line causes a considerable drop in voltage the motor will then drop out of synchronism, but instead of stopping dead as the ordinary synchronous motor would do, the motor will simply operate as an induction motor, the rotor current being short circuited through the exciter. When the line voltage returns to the normal condition, the motor will again drop into synchronism automatically.

This type of machine has met with considerable favor at different points in Canada, installations having been made as follows,—for the corporation at Preston, Ont., a 50 h.p. unit for driving centrifugal pumps; for the Toronto hydro-electric system, one 450 h.p. unit with direct-connected exciter coupled to a 300 kw. generator; for the city of Calgary, one 1500 h.p. unit with direct-connected exciter coupled to a 1000 kw. generator; for the Ontario Pulp & Paper Co., two 250 h.p. units with direct-connected exciters for pulp grinding. At the present time an installation is being put into the Ontario parliament buildings consisting of two 200 h.p. motors with direct connected exciter coupled to d.c. generators. These machines have all been supplied and installed by Messrs. Kilmer, Pullen & Burnham.

The Electrical News is published semi-monthly. Advise us if it does not reach you regularly.

City and W. E. R. Use Same Poles

Some months ago the city of Winnipeg and the Winnipeg Electric Railway Co. opened negotiations looking to the joint ownership and use of poles for the electric distribution system. The matter of agreement terms was at that time referred to Messrs. R. S. Kelsch (for the company) and J. M. Robertson (for the city), points of disagreement to be referred to the Public Utility Commission. On these latter points Commissioner Robson has now handed down his judgment, finally concluding the terms on which the two interests become equal owners of a single system of poles for the distribution of the energy of both.

While this is not the first case of joint use of poles in Canada, the idea having been successfully tried out at different points, it is the first case of such an arrangement between two systems in direct competition with one another in supplying the same kind of service. The following extracts from Commissioner Robson's report will be of interest.

"The arrangement that has been defined for a system of jointly used poles for electrical distribution by the power and light department of the city and the street railway company is a very important and novel reform. The benefits to be gained are very important. Economy is a conspicuous feature. The saving of interference of separate poles and wires in the same line will remove serious danger possibilities and the conflict which thereby ensues between the two interests. The improvement of street appearance is apparent, and is itself worth the effort.

"The serious problem arose in the cases, very general in the city, where there now exist double lines of poles and wires on the same side of a street. The company being in possession under a franchise, and being first in occupation, naturally occupied a dominant position, and had rights which the city's representatives fully recognized. The company was under no obligation to move its line or in any way abandon its position, but was willing to enter the arrangement on equitable terms. These terms have been defined in the new arrangement. The city's poles being newer and higher, are to be always used where possible, and the company's wires are to be placed thereon. The company's investment in its pole system being thus virtually extinguished, the city is to pay the cost of labor of removing the company's lines to the city's poles, and fair cost of reasonable material without improving the standard of the company's system at the expense of the city. To save involved calculation of the cost and remaining life each individual pole erected by the company (including the cost of erection) it is provided that the company shall take the abandoned poles, removing them at its own expense. Assuming the remaining life of the company's poles as erected to be ten years, the company is at the end of that time to pay to the city one-half of the then value of the city's poles to which the company shall remove its lines, and is to pay the amount it would then cost the company to affix its wires. Those experienced in such matters express the view that twenty-five years is, in this country, the average life of a pole. On these terms and within such time as the magnitude of the work and expense permit, the lines will be transferred to the city poles, and the company poles removed. Provision has been made that where only one line of poles at present exists, the other party may use it as a joint line on suitable terms. Where there is no duplication of line on the same side as in cases where the company's system occupies a different side of a street from the city's, or the city's is in the lane, the company may remove to the city's line on the same terms of compensation to the company for its cost of abandoning its line and making the change. Such a removal may be ordered in special cases by the commission. Provision is made for increasing accommodation where a pole line becomes inadequate for all lines of both interests. The Street Railway system is not to be affected, but where power and light poles or street lighting standards are available to sustain span wires that may be done on proper terms. Various details are considered, and a complete set of specifications is declared. Valuing and accounting provisions and methods of operating and regulation of work form important features. It is to be hoped that by earnest and harmonious co-operation the terms so reached may be of benefit to the two concerns in economy and facility of operation and tend to the improvement of electrical distribution in the city and the appearance of the streets, besides greatly reducing the obstruction to firemen in the performance of their duties.

"Underground construction being of a very special and expensive nature is left to be dealt with independently. This may be accomplished under the terms of present legislation, which provides for conduit construction by the city in congested districts, and for the renting of space to the company, or the company may proceed towards construction of its own conduits. The subject may also be dealt with independently under the Public Utilities act. Joint operation is feasible, but to devise adequate measures a long time will be necessary. It requires special consideration and cannot be made the subject of rules of a general character. Steps should be taken very soon with a view to placing electrical distribution in the down town section underground. There is at present too much overhead distribution. Where danger is imminent the matter should have immediate attention. There is also a large territory where this reform, while not at once urgent, is highly desirable. The matter of expense is in that stage a proper consideration. It might mean an additional and unproductive capital expenditure of very large amount. In some cities the conduit system is made a municipal project, each utility renting space. The subject has varied phases which will require careful thought on the part of those in charge, for both the city and the company."

Development on Magpie River

The Algoma Steel Corporation of Sault Ste. Marie has practically completed an installation on the Magpie river at Steep Hill Falls, power from which will be transmitted to the Helen mine five miles distant, and the Magpie mine twelve miles distant. The dam is of the Ambursen type, and is now completed. It is built of reinforced concrete with buttresses spaced twelve feet apart supporting deck slabs tapering in thickness from 30 in. at the bottom to 17 in. at the top. The height of the spillway above the river bed is 45 ft. and the total length of the spillway is 145 ft. The overall length of the dam is 230 ft. The dam is so constructed as to allow of the height being raised another 12 ft. It is interesting to note that much of the concrete of this dam was placed when the thermometer registered as low as 60 deg. below zero. The water, sand and rock were steam heated and the concrete was covered with canvas, and every possible means taken to keep it above freezing point. It is reported that the concrete put in in this way was generally satisfactory.

The total head available at this point is about 60 ft. Two turbines of the William Hamilton Co. type, Peterborough, are being installed, each with a capacity of 1000 h.p. These will be direct-connected to three-phase generators of the Crocker-Wheeler type designed to develop 900 kv.a. at 11,000 volts and 400 r.p.m. The exciter is driven by a Rodney-Hunt turbine. The switchboard is Ferranti type and provides, through a simple system of levers, for the hand operation of the oil-type switches on the generators and feeders.

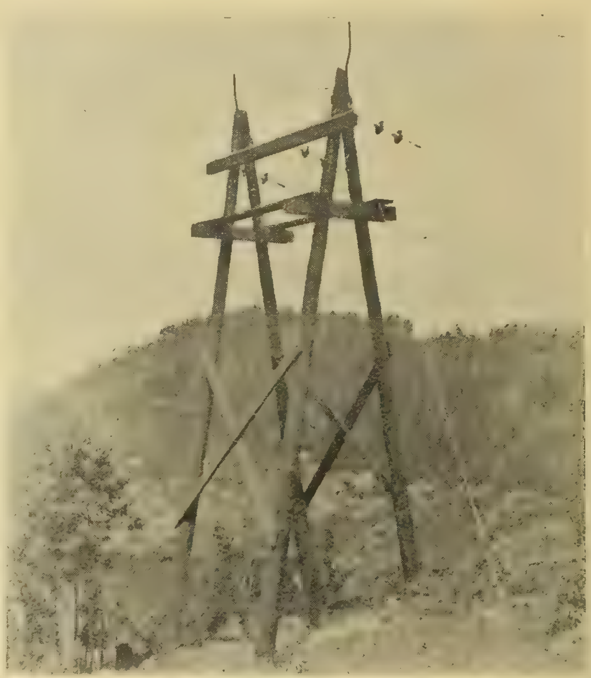
Water is led to the turbines through a steel penstock 240 ft. long and 8 ft. in diameter constructed of ¼ in. to ⅜ in. steel plates. At the power house the pipe divides into two 6 ft. branches. These are connected to a 12 ft. diameter surge tank having a total height of 80 ft. The surge tank is constructed of rivetted steel plates 7/16 in. to ¼ in. thickness. The intake is closed by racks consisting of bars ¼ in. thick, spaced 1 9/16 in. apart.

Two three-phase circuits leave the generating station, being carried on one set of poles for a distance of 1½ miles to an open air switching station, which allows of various connections being made to facilitate fault location and permits of repairs being carried out without the necessity of disconnecting the supply from both mines. From this point one line leads to the Helen mine the other to the Magpie. Three-phase current is used almost entirely at the Helen mine, being used for the main hoisting engine and the various motors driving crusher, air compressor, conveyors, pumps, etc., both on the surface and below ground. At the Magpie mine a portion of the three-phase current, after reduction to 600 volts, is used for driving a motor-generator to provide continuous current for the motors utilized for varied purposes including the ore bridge, a large travelling bridge for the handling of the ore.

On account of the strong winds that are not infrequent in this district, and are sometimes combined with low temperatures and sleet storms, which may lead to ice deposits on the wires, the line has been very strongly built from the mechanical standpoint—the poles being spaced about 130 feet apart, while double poles of the H type are provided at the ends of extra long spans. This construction is used on spans up to 480 feet. There are two spans of approximately 1000 feet on the comparatively short line to the Helen mine. These are at points where deep depressions in the ground have to be bridged. Substantial towers are provided at the ends of these spans, and the conductors are dead-ended on strain insulators. Moreover, instead of using the No. 1 size stranded aluminium conductor, as on the remainder of this section of the transmission, a conductor consisting of aluminium wires of equivalent section surrounding a central galvanized steel core wire, is provided, the mechanical strain being taken mainly by the steel core.

Steel tower supporting 1,000 ft. span over ravine

As lightning is a frequent cause of trouble during the summer months, lightning rods are provided, on the average, at every fourth pole, and over the section between generating station and open-air switching tower at junction of lines, a grounded galvanized steel cable connects the pole tops. Lightning arresters of Garton-Daniels type are provided at the generating station and at the Magpie mine sub-station, while the Helen mine sub-station is protected by multiple-gap arresters of the Westinghouse type. An attempt has also been made to relieve the wires of high potential charges before these reach the apparatus in the generating station, by providing a complete set of horn-gap arresters on the switching structure at the junction of the lines. These arresters are provided with resistances between horn-gap and ground in the form of ordinary 45 gallon barrels filled with water through which the discharge must pass.



Wood tower supporting 1,000 ft. span, Helen Mine

A telephone circuit connecting the mines and the power station is carried below the h. t. wires on the same set of poles; a complete transposition of the two telephone wires being made at every second pole. There are no transpositions on the h. t. conductors.

The Long Sault Development

In 1907 the New York legislature passed an Act granting certain rights to the Long Sault Development Co., in the vicinity of the Long Sault Rapids on the St. Lawrence river near Cornwall, Ont. This Act gave authority to develop power at that point. The United States Senate however, refused its consent to this Act becoming law and Attorney-General Carmody was requested to submit his views on the constitutionality of the Act. These views have recently been submitted to the Senate and they hold that the powers and privileges granted to the company are in direct violation of certain provisions of the state constitution and that the legislature exceeded its authority in making such grants. He says the law in question is private and local, and grants an exclusive privilege, that the land acquired is within the forest reserve, and that the act is therefore unconstitutional. The report also draws attention to the marked disparity existing between the value of the rights granted the company and the small remuneration received by the government therefor.

Rotary Converters at C.P.R. Docks

The following installation of two 600 kw. Westinghouse rotary converters with necessary equipment of transformers, equalizing generator, etc., was made during the past summer for use by the Canadian Pacific Railway Company at their new coal handling docks in Fort William.

Power is received at 25,000 volts from a 3-phase, 60 cycle line (Kaministiquia Power Company) and transformed through two sets of three 200 kw. single-phase transformers, oil-insulated, water-cooled, 60 cycle, star-connected primary 14,500 volts, delta-connected secondary 178 volts.

At the latter voltage power is delivered to the two 600 kw. 6-phase rotary converters shown in illustration No. 1. These machines give 250/280 volt d.c. 2400 amp. at 600 r.p.m., and are connected in parallel to the d.c. bus-bars.

As the load is a rapidly fluctuating one, special provision had to be made to handle the peak loads. This has been very successfully taken care of by the use of a fly-wheel, direct-connected to a d.c. machine which alternately operates as a generator or motor across the d.c. bus-bars. This is, perhaps, the first application of this system to the unloading of coal.

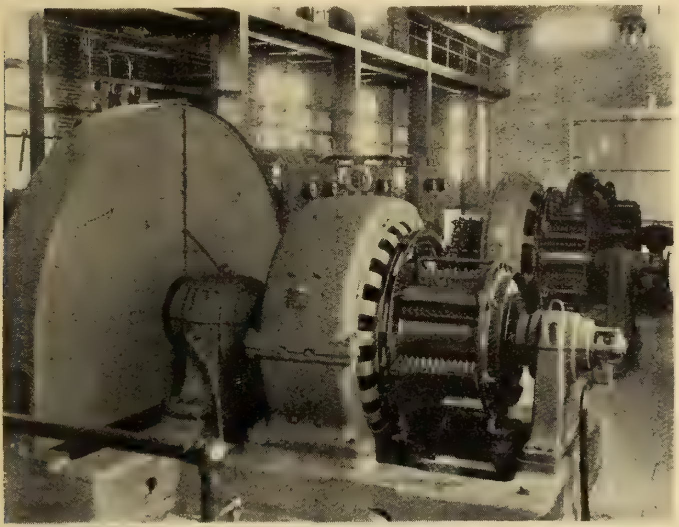


Fig. 1—Two 600 kw., 6 phase, rotary converters, Fort William

The d.c. equalizing machine is rated at 400 kw., 250 volts; is compound-wound and is capable of handling heavy overloads for short periods. The direct-connected fly-wheel weighs 15 tons made up of solid steel plates which gives a high factor of safety. The wheel is enclosed in a heavy steel plate cover. This machine has a speed variation of from 450 to 600 r.p.m. depending on what load is being taken from the d.c. bus-bars.

On light load the set automatically speeds up, taking power from the line, but with a heavy load on the line the speed tends to fall off and the generator feeds back on the line, taking power from the fly-wheel. This speed variation is obtained by changing the shunt field resistance through a water rheostat, which is operated by the special torque motor shown in the lower part of illustration No. 2.

Lightning protection is afforded by air-cooled choke coils and a three-phase type "A" electrolytic lightning arrester designed in this case for use on a 25,000 volt line. The arrester tanks are mounted in the gallery. The arrangement of the high tension bus-bar system is very open. The bus-bars are connected to the incoming line and to the transformers through type "E" 35,000 volt, three-pole, hand-operated, automatic, oil-circuit breakers shown in illustration No. 3.

Besides the transformers supplying power to the converters there are two 3-phase transformers for a.c. power purposes. They are rated at 100 kw. and transform from 25,000 volt primary to 2200 volt secondary.

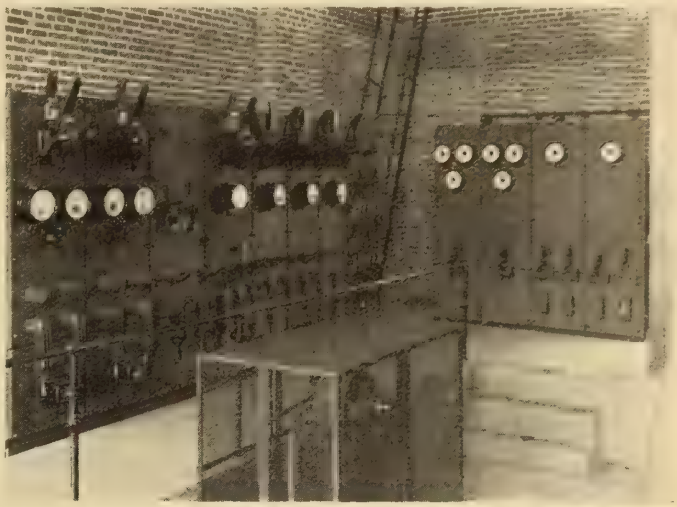


Fig. 2—A.c and d.c. switchboards, special torque motor in foreground

The switchboards are of black marine finished slate mounted on angle iron frames. A total of 17 panels has been installed. The control panel for the incoming line is located immediately in front of the transformers, while on either side of it are the panels controlling the a.c. side of the rotary converters.

At the left of illustration No. 2 is shown the d.c. control board, while the board at the right controls the 3-phase transformers.

Mr. R. S. Kelsch was consulting engineer and the equipment was manufactured by the Canadian Westinghouse Company at their Hamilton works.

Fig. 3—3-pole, hand operated, automatic oil circuit-breakers

The Berlin, Ont., Electrical Department receipts to date have been $74,538; expenditure $49,369, leaving gross profit $25,169. After deducting debenture installments this leaves a net profit of $19,631.

Montreal and Eastern Canada

After a strenuous fight, the Quebec Legislature has granted the Montreal Tramways Company an exclusive franchise for 25 years for the town of Mount Royal, which is the new name of the model city to be founded by the C. N. R. in connection with their tunnel scheme in Montreal. The Public Service Corporation, which is closely associated with the Montreal Tramways Company, secured a 15 years' franchise for the supply of light and power, a clause being inserted which allows the Montreal Light, Heat and Power Company to sell light and power to private individuals. The Tramways company have also an exclusive franchise for the neighboring parish of St. Laurent, and the Public Service Corporation a franchise for light and power, the rights of the Montreal Light, Heat and Power Company in the latter case being safeguarded. The Public Service Corporation has authority to charge ten dollars per annum for the 16 candle power incandescent lamps and varying rates, from $90 per annum to $75 per annum per 1200 candle power arc lamp, according to quantity installed; for private lighting, ten cents per kilowatt hour, with a discount of 10 per cent. on yearly contracts and a discount of 25 per cent. on five year contracts. Consumers of power must guarantee a minimum of $20 horse power per annum from one to twenty horse power, and of $15 per horse power for each additional horse power, the motor to be of a type acceptable to the company.

Quebec

The Quebec Streams Commission is a body which has been invested with the powers of a corporation in order that it may carry out a scheme of constructing a huge storage reservoir on the upper St. Maurice for the purpose of regulating the flow of that river for the generation of electricity. The Hon. S. N. Parent, chairman of this Commission, is reported to have stated that work on this dam will be commenced as early as possible and will be completed in from two to three years. It is said that the area of the proposed reservoir will be more than 300 square miles, that the amount of water to be stored will be approximately 160,000,000,000 cubic feet, and that the drainage basin will have an area of more than 16,000 square miles. It is further calculated that under these conditions a regular flow of 18,000 cubic feet will be obtained which will have an immense value for power purposes.

Amateur Wireless

Amateur operators of wireless have been some inconvenience to the Marconi Company, particularly in such large centres as Montreal and Toronto. According to Mr. J. H. Lauer, manager of the company, the proposed legislation by Mr. Hazen on radio-telegraphy will be of benefit to the company especially in the direction of controlling these private wireless stations, which interrupt commercial operations. The rigorous enforcement of the clause in the bill, imposing penalties on unlicensed amateur stations will have the desired effect of weeding out undesirable interference with, and obstruction of, legitimate messages. Most of the regulations in the Bill concerning wireless telegraphy are already in force, and the proposed legislation simply gives public recognition to the regulations.

Telephone Despatching

Four gangs of men are at work on the Grand Trunk main line between Montreal and Chicago installing a telephone system of train despatching. These men are working Toronto to Mosborough, 53.4 miles, and from Stratford to Sarnia, 81.3 miles. There remain therefore only the gaps between Lyn and Belleville, Port Hope and Toronto and Mosborough and Stratford to hinder direct telephonic communication between Sarnia and Montreal, a distance of 506.6 miles. As the completed sections mentioned above total 314.6 miles, and the gangs can average about 35 miles a week, under favorable conditions another five weeks should see the stringing of the last mile into Sarnia.

"Cedars" New Bond Issue

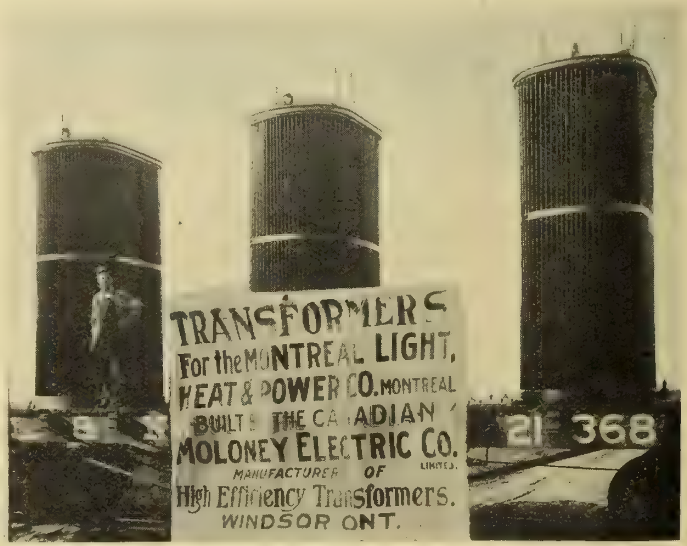
At a special meeting of the Cedars Rapids Manufacturing and Power Company, held in Montreal, on January 3, it was decided to retire the present $10,000,000 bonds, and to replace them with an issue of $15,000,000 forty year 5 per cent. first mortgage gold bonds, to be issued from time to time as required for the development of the property. Mr. J. E. Aldred, president of the company, left Montreal on the night of January 3 for New York, and it was stated would shortly leave for England.

Action for Libel

As a result of trenchant attacks on the Montreal Tramways Company—its service and financing—by the "Montreal Herald," the directors have taken action for libel, claiming $650,000 damages. The plaintiffs are Messrs. E. A. Robert, president of the company; F. H. Wilson, director; J. W. McConnell, director; J. M. Wilson, director; W. C. Finley, director; J. M. McIntyre, director. Exception is particularly taken to one article relating to the disposal of an issue of $10,000,000 capital, which the plaintiffs regard as a very serious imputation on their reputations as honorable men.

Large Transformers

The cut shown herewith represents three transformers recently supplied to the Montreal Light, Heat & Power Company, by the Canadian Moloney Electric Company, of Windsor, Ont. These transformers are oil-insulated and water-cooled. The capacity is 750 kv.a., 12,600 volts, 60 cycles. They are installed in the main sub-station of the Montreal company.



The Stuart-Howland Co., electrical supplies and specialties, Boston, announced their removal to 131-141 Federal street, beginning with the new year. This is the third time this company has removed since starting in business twelve years ago and for the same reason in each case, viz., that their business has outgrown the previous quarters. In each case they have nearly or quite doubled their floor area. Their new offices, store and wareroom will now give them ample room for handling their increasing business.

Miscellaneous

A petition has been presented in the Superior Court, Montreal, for the winding up of the Montreal Merchants' Telephone Company. The company has been in business for several years, and has about 1500 subscribers, all in the Montreal district. The petition stated that the sum of $220,000 is due to Mr. R. P. Lydon, of New York, that the company has no available means of meeting this debt, and that the directors decided on December 20 last to voluntarily wind up the company.

It is officially announced that the C. P. R. propose to extend their telegraphic facilities in Saskatchewan; the programme will include additional wires between Moose Jaw and Calgary, and Moose Jaw and Winnipeg. The facilities in northern and northwestern Saskatchewan will be increased nearly 100 per cent. The wires now working between Moose Jaw and Winnipeg will be added to.

For some time there have been persistent reports that the Bell Telephone Company is to be reorganized, and the latest rumor is that the plan involves the subsidiary companies—the Northern Electric and Manufacturing Company and the Imperial Wire and Cable Company—whose shares would be distributed proportionately to the shareholders of the Bell Telephone Company.

Mr. W. G. Ross, formerly managing director of the Montreal Street Railway Co., has been appointed chairman of the Montreal Harbor Commission, and has taken up his duties. Mr. Ross's appointment has been received with universal approval. He resigned his position with the street railway company shortly after Mr. E. A. Robert secured control.

Mr. A. B. Smith has been appointed manager of telegraphs of the Grand Trunk Railway, with headquarters at Montreal. Mr. Smith has hitherto held the same position on the Grand Trunk Pacific, with headquarters at Winnipeg, so that his jurisdiction has been very widely extended.

The National Hydro-electric Bill has been slightly amended by the Quebec Upper House. It is now agreed that in the event of the company and any municipality failing to agree as to a franchise, the Quebec Public Utilities Commission will intervene and arrange the conditions.

Mr. J. Stanley Hyman, of the Northern Electric and Manufacturing Company, died in the Western Hospital, Montreal, on Jan. 5. He had just returned from a business visit to the Maritime Provinces for his company. Mr. Hyman was 24 years of age.

Pringle Limited, incorporated with a capital stock of $20,000, to carry on business as electrical and mechanical engineers, with head office at Montreal.

The Bayliss Pulp and Paper Company, of Quebec, Que., has contracted with the Stadacona Hydraulic Company for 6,000 horse power.

New Companies

Federal Engineering Company Limited, has been incorporated with a capital of $500,000, to carry on business as manufacturers and dealers in electrical machinery, appliances, plants, etc., with head office at Toronto.

Personal

Mr. R. E. T. Pringle has resigned his position as managing director of the Canadian Moloney Electric Co., Ltd.

Mr. R. A. Ross, consulting engineer, Montreal, has been engaged by the city of Calgary to make a report on the local light and power situation.

Mr. R. T. Jeffery, for some years associated with the electrical department of Smith, Kerry & Chace, has resigned to engage in general engineering work with the Hydro-electric Power Commission of Ontario in connection with their extensive work among the various municipalities.

Mr. F. John Bell has resigned as general manager of the British Canadian Power Company, Cobalt, as the outcome of the amalgamation with the Northern Ontario Light & Power Company. He has been appointed general manager of the Canada Wire & Cable Company, Toronto.

Mr. F. J. Goodman, who has been representing the Century Telephone Construction Company in Canada, will take up his work in the United States for the same company. Mr. Goodman's place in the Canadian field is being taken by Mr. W. C. Freeman, formerly with the Stromberg-Carlson Telephone Company.

Mr. L. V. Webber, chief of the meter department of the Toronto Electric Light Co., has resigned his position to become sales manager for the Metropolitan Engineering Co. Mr. Webber's long experience with the T. E. L. Co., and his very thorough knowledge of meters fit him especially for the important work he is now undertaking.

Mr. J. A. Ellis, M.L.A., city treasurer and nominal head of the Ottawa Municipal Electric Department, was elected mayor of Ottawa for 1913 on Monday ,January 6th, by a substantial majority over two other candidates. Mr. Ellis, who has been secretary of the municipal electric department, will still hold that position, but will not accept salary while he holds office as mayor.

Mr. Jas. Anderson, manager, the Sandwich, Windsor & Amherstburg Railway Company, sails for Europe on January 21st, via the White Star line steamer Cedric. Mr. Anderson will travel by way of the Mediterranean and thence north through various points of interest, and will be absent about three months. Mr. A. M. Stewart, ticket agent of the Grand Trunk railway system of Windsor, will accompany Mr. Anderson.

Mr. J. D. Evans, chief engineer of the Montreal Tramways Company, has resigned to become construction manager of the Electric Bond and Share Company, of New York. Mr. Evans is a graduate of the Massachusetts Institute of Technology. He has been at different times in the employ of the U. S. Government in connection with the Panama Canal work, and of the Republic of Equador in steam railway construction, and later has been engaged in electrical work for the Great Northern Power Company, the Canadian Light and Power Company and other large private corporations, before associating himself with the Montreal Tramways Co.

The Canadian British Engineering Company

Announcement is made by The Canadian British Engineering Company of the purchase of the stock-in-trade of the James Stuart Electric Company, of Winnipeg, with the intention of carrying on this well-known wholesale electric supply business at the old address, 324 Smith street. The warehouse and showroom of this company will have a combined floor space of over 15,000 square feet, which will enable them to carry a large variety of stock.

Prairie Province Activities

Port Arthur, Ont.

Activity in Port Arthur is shown by the number of by-laws recently submitted which approximate three-quarters of a million dollars. This sum includes an expenditure of $12,000 for a motor-generator, $6,550 for extending the municipal railway system, $32,400 for the re-laying of tracks with heavier steel, $35,000 for extensions and improvements to the telephone system, $6,500 for completing the service dam on Current River in connection with the city's power developing scheme, $8,000 to extend the street lighting system and $30,000 to extend and improve the electric lighting system.

The following figures, showing the estimated cost of constructing single track, in pavement, on Algoma street from Arthur to Cameron streets are of interest. This includes paving that portion of the street between the rails and for a distance of eighteen inches on each side of the rails.

Rails	$ 823.00
Rails, hauling	40.00
Ties	168.00
Spikes	27.00
Angle Bars	26.40
Bolts	6.25
Bonds	8.80
Bonding	17.60
Earth excavation	165.10
Track laying	228.60
Earth overhaul	38.10
Extra concrete	1,315.31
Paving	2,131.29
	$4,995.45
Overhead work	600.00
Supervision and contingencies	555.55
	$6,151.00
Interest six months at 5c	307.55
	$6,458.55
Advertising	91.45
Total	$6,550.00

Edmonton's Proposed Belt Line System

The city of Edmonton has drawn up a comprehensive plan of street railway extension work designed, at the same time, to economically meet the needs of the present population and also to be capable of almost unlimited expansion to keep pace with the city's prospective growth of the next decade.

The system mentioned is comprised of 15 routes, all of which are belt lines, and which are so arranged that at no point inside the district covered will an intending passenger have to walk more than two or three blocks to reach the car. Based on a 15-minute headway each way on individual routes, the number of cars passing various points in the city will vary from eight cars per hour to seventy-two, the latter, of course, being in the more congested business district.

The total length of track required for this lay-out is approximately 110 miles, and it is estimated that 220 cars will be sufficient to maintain the regular schedule.

The railway department proposes to make all future extensions of track with a view to ultimately attaining this lay-out. The length of time taken for this will, of course, depend upon the rate of growth of the city.

The system has been so designed that, should unforeseen circumstances require it, any of these routes may be shifted a block or two in either direction without disarranging the main plans.

Minnedosa, Man.

An electrical plant is being installed in Minnedosa at the present time which it is expected will be in operation in the course of six weeks or two months. One generator only is at present being installed consisting of a 312½ kv.a., 60 cycle, 3-phase, 2400 volt, horizontal unit running at 257 r.p.m. The exciter is a 20 kw., 125 volt, 600 r.p.m. The switchboard consists of two panels, one for exciter and one for the a.c. generator, the generator panel having an a.c. ammeter on each phase, high tension volt meter, exciter ammeter, and time relay. The exciter panel at present carries only an ammeter and a d.c. volt meter. The exciter is a compound-wound interpole machine sufficiently large to supply the exciting current to a duplicate alternator, when the plant is extended, the power house being laid out for such an extension. The exciter is driven by an independent turbine.

All the electrical installations are being supplied by Messrs. Kilmer, Pullen and Burnham, Canadian agents for the Swedish General Electric Co. The turbines were manufactured by Wm. Kennedy & Sons, Owen Sound, Ont., and are designed to operate under an effective head of 25 feet. In addition to the regular fore-bay supply of water, there is also a reserve supply obtained by means of damming a lake some thirty-five miles north of Minnedosa. C. H. and P. H. Mitchell are consulting engineers for the municipality.

Dauphin, Man.

Contract has been awarded to E. Leonard & Sons, of London, Ont., for two horizontal return tubular boilers and one tandem compound engine. The Canadian General Electric Company is supplying a 125 kw. generator. The latter company also have the contract for the supply and erection of a distribution system, including forty series tungsten street lights and thirty-five ornamental standards. Bids will be received and contract awarded for brick power house at an early date.

Mr. R. A. Ross, of Montreal, has been engaged by the city of Calgary to report on the local power and light situation.

New Publications

The practical Electrician's Pocket-book and Diary, 1913; 1s net; S. Rentall & Co., Ltd., 36 Maiden Lane, Strand, W. C. London, Eng., publishers; edited by H. T. Crewe, M.I. Mech. E. The contents of this book are chiefly compiled for readers who are for the most part practically engaged in one or other of the many branches of trade in which electricity now plays an important part. This year's publication is some forty-four pages in excess of the 1912 edition in spite of the fact that certain standard sections have been omitted. The larger size is due to the inclusion of a quantity of new matter which has been brought into more prominent notice during the past year, such as coal cutting machines, electric vacuum cleaners, and control of lighting circuits. The appendix contains useful tables of various kinds, for example, a table showing the size of cable to be used on circuits carrying various currents at different voltages. This book can be safely recommended as reliable, and certain to prove of real value to the practical man.

New Equipment for Nanaimo

The rapid growth of the city of Nanaimo has called for a large increase in the amount of current used for lighting and heating purposes, and the Nanaimo Electric Company have found difficulty in meeting the ever increasing demand although they have made several additions to their plant within the last two years. At the commencement of this year they found that their present service would be severely overloaded during the present winter and this article will deal with the provisions they have been making to meet their calls for power.

Their plant up to the present has consisted of a substantial brick building containing the following equipment:—A set of three Pelton water wheels capable of developing 500 h.p. and for emergency and overload service they have one 16½ in. x 24 in. side-crank piston valve engine. This engine is supplied with steam from two return tubular boilers working at a pressure of 120 lbs. The water wheels are belted to a line shaft from which are driven one 25 kw., d.c. arc machine, one 50 kw., d.c. arc machine, one 150 kw., 3 phase, 2300 volt revolving field alternator excited by one 5½ kw., d.c. bipolar generator, and one 120 kw., single phase, 1154 volt alternator with direct connected exciter.

As the supply of water available for power purposes was limited, Mr. Joseph Hunter, president of the company and chief engineer for the Canadian Collieries, Ltd., decided that to increase the capacity of their plant it would be necessary to install either a direct connected steam engine driven generator set or a turbine driven set. Owing to the difficulty of obtaining an adequate supply of water for condensing purposes which would permit of their installing a turbo-generator set having reasonable steam economy, it was decided that the only type of apparatus that would be at all economical was a compound high speed engine generating set arranged to run non-condensing for the present but designed so that at some future time condensers might be added.

Acting on advice from Mr. Frank Sawford, chief electrical engineer for the Canadian Collieries and upon Mr. Hunter's suggestions, Mr. William Lewis, general manager for the Nanaimo Electric Light Company, made a contract with Messrs. Taylor and Young, Ltd., mechanical engineers, of Vancouver to supply and erect a 450 B.h.p. compound high speed engine manufactured by Messrs. Jas. Howden & Co., of Glasgow, Scotland, for direct connection to a 300 kw., 2200 volt alternator with direct connected exciter, manufactured by Messrs. Bruce Peebles & Company of Edinburgh, Scotland. This complete unit is to be delivered and erected by the firm who were awarded the contract and as it is the first installation of its kind in British Columbia full particulars concerning it will be of special interest. The following is a fairly complete specification of the unit that has been ordered consisting of one 300 kv.a. direct-connected steam-driven alternating current generating set.

Engine

One "Howden" two crank compound double-acting vertical engine of the enclosed type fitted with their patent improved system of forced lubrication, to develop 450 brake horse-power at 360 revolutions per minute, with a steam pressure of 125 lbs. per square inch at the stop valve when exhausting into atmosphere. The engine is mounted upon a short base, the dynamo being upon its own horse shoe type bed plate and connected up through the shafts.

Frame—The working parts are enclosed in a strong vertical casing accurately machined top and bottom and securely bolted to base. Large doors secured by nuts are provided at both sides giving unrestricted access, and small hinged doors opening with one handle are provided for ready access to facilitate examination. Distance pieces carrying the cylinders are secured to the top of the casing, sufficient height being provided to ensure that the oil is not drawn up from the crank-case to l.p. cylinder when working condensing.

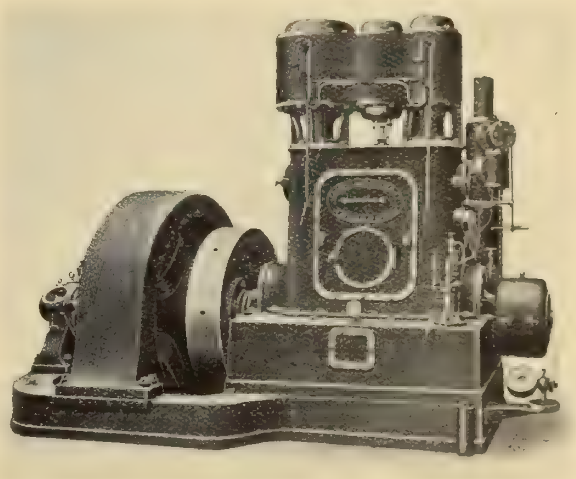
Cylinders and Pistons—The cylinders are of the best hard close-grained cast iron in one piece with valve casing between them which is fitted with improved piston-type slide valve distributing steam to both cylinders,—external steam piping between cylinders is entirely dispensed with thus avoiding considerable loss from condensation. Both sides of pistons, and insides of cylinder covers are turned and polished. The cylinders are neatly covered with blue planished sheet steel, the cylinder covers and valve chest covers being similarly finished and covered, the space under planished plate being filled with asbestos fibre. The pistons are made in one piece, the low pressure being made of cast steel. Two cast iron packing rings, accurately machined, are fitted to each piston, the arrangement being specially suitable for high pressures and high temperatures.

Packings—Piston rods and valve rods are provided with metallic packings of improved type.

Piston Rods—are of high carbon steel, accurately finished on special grinding machine, and secured by fitted bolts to cast steel crosshead.

Crosshead Pins—are of mild steel, case-hardened and ground after hardening.

Connecting Rods—are unusually long, viz: seven times the length of cranks, reducing pressure on guides and connecting to exceptionally smooth running and absence of vibration.



Type of Equipment being Installed in Nanaimo

Crank Shaft—is of Siemens Martin steel, with throws cut out of the solid. There are four bearings in the crank case, giving exceptionally large bearing surfaces, all being lined with Richards' anti-friction metal. The cranks are placed opposite, thus balancing each other.

Governor—is carried directly on the crank shaft and actuates a double beat throttle valve, controlling the speed to within 2 per cent. variation from full load to no load. Momentary variations, full load instantaneously switched off and on, 5 per cent.

Speed Regulating Gear—This is arranged to permit of a 10 per cent. variation while the engine is running.

Flywheel—A heavy flywheel, machined all over, with polished rim, is fitted, ensuring a minimum momentary variation of speed under a fluctuating load.

Overloads—The engine is fitted with a by-pass valve to enable it to carry 25 per cent. overload for two hours which would be available on the alternator. This by-pass valve admits high pressure steam into the low pressure cylinder.

Efficiency—The mechanical efficiency of the engine is not less than 92½ per cent. at full load.

Accessories—Sight feed lubricator, steam pressure gauge, oil pressure gauge, cylinder drain cocks and pipes, relief valves, tachometer, set of spanners and tools, barring lever, set of foundation bolts and anchor plates are included.

Alternator

One 300 kv.a., 3 phase, 2200 volt Bruce Peebles alternator mounted on horse shoe type bed plate and connected to engine through coupling.

Capacity—The alternator will be designed for a normal full load capacity of 300 kv.a. at unity power-factor, 2200 volts, 60 cycles, 3 phase when running at a speed of 360 r.p.m.

Temperature Rise — This measured thermometrically after 24 hours' full load run will not exceed 23.9° C. above that of the surrounding atmosphere and 37.8° C. after two hours' run at 25 per cent. overload.

Efficiency—The efficiency of the alternator at the various loads and at unity power-factor will be as follows:—full load 92½ per cent.; ¾ load 91½ per cent.; ½ load 89 per cent.; ¼ load 81 per cent.

Voltage Regulation—The voltage rise when full load is switched off will not exceed 7.5 per cent. assuming constant speed and excitation and unity power-factor.

Exciter—The exciter for this alternator is mounted on an extension of the armature shaft and has an independent outboard pedestal bearing.

One of the noteworthy features of this installation is its low steam consumption under steam conditions which are to say the least not favorable, the consumption of the combined set at full-load not exceeding thirty-two pounds per kw. hour when operating non-condensing.

Messrs. Taylor and Young, whose name has been identified with steam power plant engineering for some time and who recently installed a large special turbine-driven Fire Underwriters' pump for the North Pacific Lumber Company at Barnet, B.C., are to be congratulated on having been instrumental in introducing the first high speed engine of any size into British Columbia.

Telephones and Telegraphy

A public warning has been issued by the Bell Telephone Company against the use of unauthorized mouth pieces and other devices. Mr. R. F. Jones, the Montreal manager of the company, states that these devices are detrimental to efficient service, and that best results are obtained from the regular sets supplied to subscribers, without the use of these so-called "improvements." Under the terms of contracts made with subscribers these attachments are not allowed, and Mr. Jones states that the service would be brought to something approaching a standstill if the company were to allow each subscriber to use any freak attachment that he wished. The company object to rubber sound mufflers, designed to prevent by-standers hearing what is said; "hear plain" patent devices for increasing the volume of the voice; and "handless telephones," the object of which is to do away with the necessity of holding the receiver to the ear. Objection is also made to the many devices which claim to provide sanitary conditions in the mouth-piece, the majority being dependent for their efficiency upon repeated treatment with a form of liquid disinfectant. Dr. Harold Spitta, bacteriologist to the British Royal Household, has made a number of investigations into the question of the transmission of consumption by means of telephone mouth-pieces, and has reported to the British Postmaster-General that such transmission is practically impossible. The telephone companies have also made extensive experiments on the same subject, and the opinion of Dr. Spitta is in harmony with the results of these experiments.

Proper Atmosphere for Telephone Employees

Contracts have just been signed for the installation of apparatus for purifying the air in the switch and toll rooms of the Citizens' Telephone Company of Grand Rapids. The arrangement provides for working in rooms closed practically air-tight. The windows will be double and all crevices and cracks will be tightly caulked and the doors will be closely guarded. The air for about fifty employees will be fanned into these rooms passing through sprays of water so as to be cleaned of all dust or other impurities. This air will then pass over coils which will warm it in winter and cool it in summer. From the coils the air will pass through a dehumidizing machine which will take the moisture out of it or release moisture to it so as to maintain a certain standard. It is guaranteed that this apparatus will produce air that will not vary 5 degrees in temperature or 5 per cent. in humidity.

The Welland County Telephone Co.

This company are now installing at the Ridgeway exchange, a two position, 200 line magneto switchboard of modern design and equipment. The Welland County Telephone Co. have enjoyed a steady and continuous growth since organization some five years ago and now have exchanges in Bridgeburg, Fort Erie, Ridgeway and Stevensville, and are giving service to practically all points in Welland county. They have upwards of 800 telephones on their system and because of the extraordinary demand for their service it has been deemed advisable to install the above larger equipment in Ridgeway. This company are an independent company and connect with the system of the Federal Telephone and Telegraph Co. of Buffalo by means of a submarine cable laid across the Niagara river. This gives them an extensive long distance service.

The Bruce Municipal Telephone Company

Practically all of Bruce County is covered by the lines of the new Bruce Municipal Telephone Company. Exchanges have been installed and are now operating at Port Elgin, Paisley, Underwood, Tiverton and Kincardine, and very nearly 1,000 subscribers are now connected for service. All exchanges are connected by through trunk lines and experiments are now being conducted with phantom circuits for trunking service. When the construction work of this company has been completed, the Bruce municipal company will have the largest system of this kind in eastern Canada.

St. Marys, Kirkton & Exeter Telephone Company

During the winter season many improvements have been made in this company's system. A new switchboard of 150-line capacity has been installed at their Granton exchange. This is to take care of extensive development work which will be undertaken early in the spring. This company is undoubtedly one of the most progressive in western Ontario and a very large share of their phenomenal growth has been due to the efforts of Mr. John Perry, general manager of the company. Their directory now contains between 400 and 500 names and service is being given at St. Marys, Granton, Kirkton, Exeter and the adjacent rural districts.

Advises Automatic for New Zealand

A report has been presented by Mr. Buckley, chief electrician of the post and telegraph department of New Zealand, who last year toured America, England and Europe with the object of studying various systems of telegraphy and telephony. He states that an automatic system of telephones would most satisfactorily meet the requirements of New Zealand and would possibly permit of an extension of the area within which a minimum residential rate might be charged. Mr. Buckley computes that a saving of over $10,000 a year might be expected from an automatic system at each of the four cities, namely, Auckland, Christchurch, Dunedin, and Wellington.

New Books

Wireless Telegraphy and Telephony Simply Explained.—by A. P. Morgan. The Norman W. Henley Publishing Company, New York. Price $1.00. This is a practical treatise embracing complete and detailed explanations of the theory and practice of modern radio apparatus and its present-day application, together with a chapter on the possibilities of its future development. The author has endeavored to furnish a comprehensive explanation in simple language of the theory and practice of this wonderful art and to explain as far as possible the importance of the position occupied by wireless telegraphy to-day and the possibilities of tomorrow.

Improved Maritime Telegraph Service

Important improvements are being made in the telegraph service of Prince Edward Island, to meet both the growth of existing traffic and the further expansion which the operation of the new car ferry will entail. The rate of 30 cents per 50 words for night letters, which has been in effect on the mainland for some time, was extended to include the island offices on November 7, 1912, and was at once availed of very eagerly. Moreover, during the summer and autumn of 1912 five gangs of linesmen were engaged in rebuilding and improving the telegraph lines throughout the province under the direction of the leading construction officer for eastern Canada of the Western Union Telegraph Company.

Most important of all, negotiations have been active and thus far successful for the laying of a new multiple cable across Northumberland Strait to supplement the present cable connecting Prince Edward Island with the mainland. This new cable will cost approximately $45,000, and will contain one wire each for the Dominion Government and the existing telegraph system. These wires will handle principally the extra business caused by the car ferry, but they will incidentally furnish an emergency connection with the mainland for general purposes whenever the present cable may be out of order. In addition to the two wires mentioned the new cable will for the first time provide permanent telephonic communication across the strait.

Cable connection across Northumberland Strait was first established by the New York, Newfoundland & London Telegraph Company in 1853, and this line is said to be the oldest submarine cable in active operation in North America. In 1869 the Island government contracted with the company above named for a new cable to be subsidized annually in the sum of $1,947. In accordance with this agreement the cable was laid in 1873, being an unused end of the Atlantic cable of 1866. In the same year, when Prince Edward Island became a part of the Dominion, the Government of Canada placed itself under statutory obligation to support adequate telegraphic communication with the mainland, and accordingly took over the subsidy agreement of 1869. In 1904, in order to secure for the island equal rates with the mainland as well as better night and delivery service, the Dominion increased the subsidy by $5,000 per annum, so that the present payment aggregates $6,947. In the autumn of 1911 the cable and telegraph facilities of the island were acquired by the Western Union Telegraph Company, through a 99 year lease commencing on January 1, 1912. The system thus taken over consists of 317.5 miles of land lines on Prince Edward Island, about 9 miles of cable from Cape Traverse to Cape Tormentine, and some 35 miles of land wires from the latter point to Sackville, in New Brunswick. The current is supplied by gravity cells instead of the storage batteries which have been coming into use on the mainland. There are 28 telegraph offices upon the island.

New Cable Rates

It is announced that a new agreement has been completed between the Newfoundland government and the Canadian Marconi Co., whereby the number of stations in Newfoundland will be increased from five to ten, and the Canadian Marconi Co. undertakes to operate them until the year 1926. The company will receive from the government a subsidy of $4,500 per annum and other minor considerations in exchange for exclusive rights in Newfoundland until that date. As a result of this arrangement it is also stated that rates for through messages to and from ships at sea and any inland telegraph point in Canada or the United States will be lowered.

A recent advice from London stated that further reductions in cable rates would take place on January 1st. The rate for deferred telegrams to Newfoundland and the United States is reduced by 1½c per word for messages sent via the Anglo-American Cable Co., direct to the United States. The Western Union Cable rates for day and week-end cable letters to the same countries will also be reduced and the periods of the delay decreased. In the case of cable letters the rates for places in the east of Canada and the United States is reduced from 6s for 21 words to 3s for 13 words and instead of being delivered on the second day after they are despatched, will reach addresses the day after. The new rate for week-end cable letters is 4s 6d for 25 words to be delivered on Monday instead of Tuesday as at present. The rates for both classes of telegrams to other places in Canada and the United States vary according to the service.

A series of week-end cable letters will be inaugurated with Australia, New Zealand and certain British South African points. The charge for week-end cable letters to Australia and New Zealand is 18s for 24 words and 5d for every word over this limit. This rate will include the charge for delivery by post from the offices of the cable companies in Australia, New Zealand and South Africa.

Electric Trucks

The Eugene F. Phillips Electrical Works, Limited, have recently purchased a G. V. one ton capacity electric industrial truck. This truck is supplied with an electrically operated crane mounted on the front. This crane is used for loading material from the floor to the truck and from the truck to the cars or the reverse. Both the truck and the crane are operated by storage batteries.

Steel Belting for Power Transmission

The use of steel belts in some of the large manufacturing establishments of Huddersfield during the past year has been most satisfactory. At a local mill a steel belt 7¾ inches wide, weighing 119 pounds, performs the work formerly done by a leather belt 22 inches wide, weighing 814 pounds, driving 300 horse power. In another mill a steel belt 3½ inches wide, weighing 12 pounds, does work in driving 40 horse power that formerly required a leather belt 12 inches wide, weighing 64 pounds. The steel belt is an economizer of space, does not slip or stretch, and gives the greatest efficiency of power delivery. A government test has shown a saving of 61 horse power on a drive of 640 horse power in using the steel belt.

New Developments, Improved Designs, 1912

A Brief Review of the Trend During the Past Twelve Months in the Different Phases of Modern Electric Practice (concluded)

The Electric Vehicle

Probably the greatest advance has been made in pleasure vehicles, though noticeable progress has also been made in commercial trucks. For pleasure vehicles the coupe type of body continues to be the most popular, improvements in design having made this a most attractive and comfortable vehicle. The five-passenger electric cars, a novelty of a few years ago, are now quite popular.

Better operating characteristics are shown, due to improvements in motor, controller, battery and transmission. The motor is more efficient and rugged, quieter and lighter in weight. Chain drive is being largely replaced by some form of gear drive in which the motor is either mounted directly on the rear axle or on the chassis and connected up by a jointed shaft. Improvements have been made in the chassis and body rendering entrance and exit easier as well as making riding more comfortable. Cars are more easily taken care of due to simplified charging devices available for garages. Central stations are appreciating more and more the value of an electric vehicle load and many of them are establishing charging points at different places in and out of the congested districts.

The limited capacity and slow speed objections often raised against the electric vehicles are gradually being eliminated though the electric car is not yet and probably never will be a competitor of the gasoline car. It is developing a field of its own which will be limited to city and residence districts where it promises to far excl the gasoline car. The manufacturers now realize that "record" trips mean little to the reputation of an electric vehicle and places this car in a wrong light before the purchasing public.

The electric truck is increasing in numbers at a remarkably rapid rate. Companies, including various industries which had tried them out in individual cases are now using them in large fleets.

Excellent and accurate data of operation and maintenance which has been secured and distributed by the manufacturers of electric trucks are doing much to advance the cause of the electric. The Electric Vehicle Association of America and several of the largest central stations have also done much to promote the use of electrics by publicity along broad lines. Another particularly interesting feature and a very praiseworthy one is the close co-operation of the three interests most intimately affected, namely: The manufacturers of the vehicle, the manufacturers of its component parts, and the central stations which supply the current.

The past year has seen the establishment of a very promising factory in Canada. The product of this factory appears to have gone a long way towards the solution of many of the problems which have retarded the more general use of electric vehicles in the past. Capacity is greater, the speed is higher, the life is longer, and the general design of the car seems to assure great popularity for this electric machine when it is placed on the market in commercial quantities.

General Illumination

Illumination as a science has made distinct advances during the year and it is coming to be recognized that in the past much good light has been used to poor effect and much work has been badly done for lack of knowledge of the requirements of scientific distribution of the electric units. It has come to be recognized that the cost of a proper lighting installation is small as compared with the increased quality and quantity of work that an individual can perform under the more favorable conditions.

In the home and office indirect and semi-indirect illumination have made noticeable progress. Improvements in reflectors, the better placing of units, and the greater consideration that is being given to the proper type of ceiling has done much to reduce the cost of indirect lighting. The semi-indirect, perhaps a more pleasing form, is now being treated very scientifically and with much less loss of light. A type of indirect illumination which has recently been brought into Canada requires the use of an arc lamp surmounted above an indirect reflector. This type of indirect is very efficient and doubtless will do much to increase the popularity of indirect illumination.

In street lighting, while the five-light standard using tungsten lamps is still being very generally installed even in our smaller towns and in some cases in our villages and along country roads, there is a decided tendency towards single light ornamental standards which offer greater efficiencies in operation. In certain cases one large tungsten unit is used but in a number of noticeable installations, an arc lamp surrounded by a large globe is the source of light. These are especially applicable to streets comparatively free of trees as the source of light is rather too powerful to be placed less than fourteen to sixteen feet from the ground

Household Appliances

As stated under the heading "Small Motors," much work that was formerly performed by hand is now being automatically taken care of by small motors. The washer, the wringer, sewing machines, grinders, etc., are increasingly popular. Electricity has now been adapted to practically every operation in the home and these are rapidly coming to be looked on as necessities rather than, as a few years ago, as luxuries. This equipment is becoming more efficient, more compact, will last longer and costs less to operate than formerly. Perhaps the greatest advance has been made in the electric radiator of which there is now a great variety on the market and although these are yet looked upon as somewhat of a luxury, yet, considering the added advantages of cleanliness, cosy appearance, and sanitary considerations, there are many instances where energy is cheap enough to outweigh all disadvantages.

Arc Lamps

Developments during the year have been confined almost exclusively to flame carbon arc lamps of the long burning type. Ten to forty hour lamps have been used very extensively abroad for some time and their general adoption in this country has been only delayed by the comparatively high maintenance cost, resulting from the necessity of frequent trimming and high price of carbons.

The long-life lamp however, is overcoming these obstacles and is now being used in large numbers not only for street but also for display lighting and especially for industrial plants, wharves, docks and large public buildings. The fact that carbons giving either white or yellow light may be used, renders the adaptability of the lamp more flexible. The rapid and very satisfactory progress made by carbon manufacturers in providing suitable carbons has materially aided in the development of the arc lamp and its adoption. One company at least is utilizing an arc lamp for indirect illumination and a suitable type is being adapted to ornamental standards and promises to take the place of the five light tungsten clusters. Inasmuch as the demand is always for more light at a lower maintenance cost, the outlook for the arc lamp is very bright.

Rectifiers

The vibrating type rectifier has just been placed on the market. This will very satisfactorily take care of the charging of batteries used for vehicle lighting and gas engine ignition purposes. It is neatly designed, compact and light, and may readily be carried on the vehicle and is of particular benefit to the motor car owner who has a three-cell battery equipment as it enables him to charge the batteries at his convenience with small expense, directly from an alternating current lighting circuit.

The apparatus consists essentially of a polarized relay acted upon by two alternating current magnets so that it vibrates in synchronism with the alternations of the current, and arranged to reverse the connections of the circuit as the current reverses. The vibrating arm is magnetized by current from the direct current side, so that one end is permanently north and the other end permanently south, depending on which way the battery is connected. The two stationary electromagnets are wound so that their upper ends are of the same polarity at each instant. When the alternating current is in one direction the upper poles of both stationary magnets are north, attracting the south end of the vibrating arm and repelling the north end. This connects the alternating current to the direct-current circuit in one direction. When the alternating current reverses, the poles of the alternating current magnets become south, attracting the north end of the vibrating arm and repelling the south end. This reverses the connection of the alternating current to the direct current circuit, but as the direction of current has also reversed, the current flows into the direct-current circuit in the same direction as before. The reversal of the connections thus takes place every time the current reverses, so that the result is a pulsating direct current. A transformer reduces the voltage to the proper value.

Small Motors

No radical change in the general features and design of either a.c. or d.c. small motors has been made, but progress is noted in the details of design and process of manufacture tending to lighter weight, more compact construction and reliable operation. Materials are used to better advantage than formerly and a.c. and d.c. motors of the same capacity are practically interchangeable in so far as mounting is concerned, a feature of great importance to manufacturers of motor-driven machines. Improvements have been made in the starting torque and centrifugal clutch of the single phase motor enabling it to take care of the majority of starting conditions met with. The range of application of the small motor is wide, but the demand during the past year has centred in the home and the office, more particularly on washing, dictating, tabulating, mailing and similar machines and vacuum cleaners. The increased demand has resulted in larger production, which in turn has lowered the price to the user. The public is now getting to look on these and other electrical appliances in the light of necessities rather than luxuries, and the small motor may now be regarded as a commercial article with a field of its own. Especially it is noticeable that they are being used more and more in connection with labor-saving devices, and as a result have been the means of increasing the amount of useful energy expended by the individual, because it relieves him of the amount of physical energy necessary to perform the labor which the motor now does and gives him time to devote his energy to more profitable ends.

Steam Turbines, Condensers and Gas Products

The character of steam turbine business during the past year has been a general broadening of the lines. Large, complete expansion machines are coming very much into demand. Several negotiations are in progress, which involve the use of machines of 25,000 to 30,000 kw. capacity. Bleeder turbines, a more or less recent type, have justified the expectations of those who were responsible for their original design, and are being built now in sizes as large as 4,000 kw. Non-condensing turbines have also been built of 3500 kw. capacity within the year. The small turbine continues to develop very rapidly.

Lightning Arresters

The electrolytic lightning arrester in the higher voltages has been changed so as to include smaller diameter tanks. The same degree of insulation is obtained by lining the tanks with a substance which is absolutely impervious to water; thus providing constant and adequate insulation at all times.

For the highest voltages, this type is now supplied upon special order with elliptical instead of round tanks. These tanks allow of mounting two stacks of trays side by side, and this design is used where there is not sufficient headroom to allow for the standard round tanks with all trays in one vertical stack.

Installation in Mond Nickel Mine

The conditions in the North Ontario mining district were from the start very favorable to the introduction of electric drive for all mining purposes. Fuel is very expensive in this district and the mines are often located a very great distance from the trunk lines of the railroads so that the transportation of fuel becomes a serious problem. On the other hand, the country has many water falls which can be used for the generation of electrical energy with a very small amount of investment for maintenance. As a result of this all the larger properties in the Ontario district operate their hoists, pumps, blowers, etc., by electrical energy, which sometimes is transmitted over long distances.

One example of such an installation, which has been in operation over ten years, is the mine of the Mond Nickel Company at Mond Nickel located on the C. P. R. This company produces a rich nickel ore from a mine of approximately 1000 feet depth. The ore is reduced in the company's smelter at Mond Nickel to which it is conveyed by means of a cable-way. The company has its own power station from which power is supplied over a high tension line to the mine sub-station and to the sub-station at the smelter. The

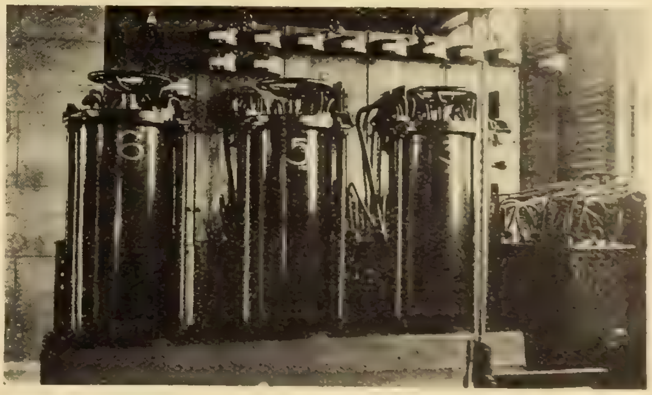


Fig. 1. Potential type motor starters, Mond Nickel

sub-station is located approximately four miles from the smelter and railroad station.

The mine hoist is partly shown in Figs. 2 and 3. It is a double drum hoist and is driven by a 300 h.p., 550 volt, Allis-Chalmers-Bullock slip-ring type motor. The motor is controlled by a Cutler-Hammer series relay type, reversible controller installed to the right of the hoist motor. Fig. 2, which is in turn controlled by a master drum shown mounted on the operator's platform in Fig. 3. The controller consists of two double pole, alternating current contactor switches with blowouts for the control and reversal of the primary circuit, and a number of double pole switches of the same design for the control of resistance in the secondary circuit of the motor. These secondary switches are in turn controlled by 3-phase series relays connected in the secondary circuit in such a way that they prevent the closing of the accelerating switches until the motor has come up to a certain speed and the accelerating current has dropped to a predetermined value, which can be varied by changing the adjustment of the series relays. The master drum is of the multi-step type and is an ordinary cylinder type drum controller by means of which the operator is enabled to start and reverse the motor and run it at any speed desired. Should he throw the master drum quickly to the fullspeed position, the motor resistance would not be cut out suddenly (which would result in a heavy overload on the line), but the acceleration is under the control of the series relays described above and the motor will come up to speed gradually without line troubles and without injury to the motor winding. The hoist is stopped by means of hand operated brakes and is further equipped with an emergency brake, which is set by a falling weight, this weight being held suspended by a latch. On failure of the line current, this latch is tripped by an alternating current solenoid and after the current is re-established the brake is re-set by hand. The motor-starting control apparatus was furnished by the Cutler-Hammer Mfg. Co. of Milwaukee.

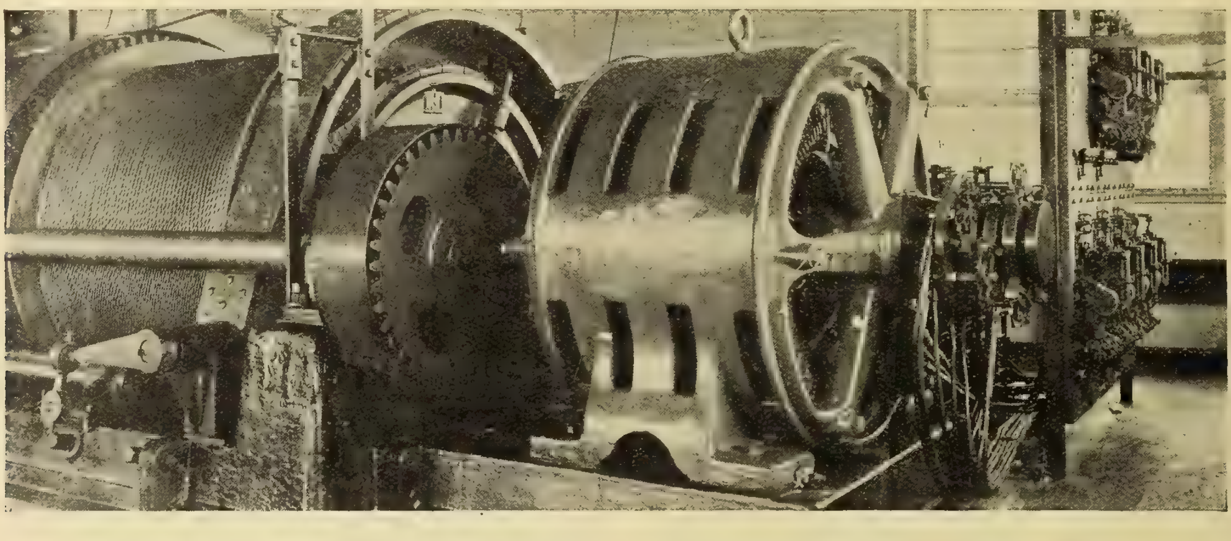


Fig. 2—Right hand drum of double-drum mine hoist driven by slip-ring motor, Mond Nickel Mine

In the sub-station there are three transformers which step down the high tension to 550 volts, at which voltage all motors are operated. The sub-station also contains one 300 h.p., 550 volt, motor-driven turbine pump for draining the mine, two 75 h.p. motor-driven blowers and one 300 h.p motor-driven air compressor. The last mentioned motors are all controlled by means of drum type potential starters, shown in Fig. 1. These potential starters are mounted in front of the switchboard, which carries the necessary indicating instruments and the oil switches for the individual motors. The drums are of the cylinder type and all contacts are oil-immersed. The leads are brought out through the cover of the controller and are sealed with an oil-proof cement, which prevents creepage of oil along the leads. The top forms, at the same time, the support for all contact parts and for the oil case, which consists of a seamless tank. This tank may be lowered by means of crank and chains below the floor line so that all contact parts are readily accessible for inspection. The top cover rests on a cast iron ring which is supported from the floor by means of three gas pipes. This type of vertical drum for large size potential starters is very satisfactory for the reason that it can be mounted in front of the switchboard in such a manner that the drums are directly opposite the indicating instruments on the switchboard, so that while starting up the motors the operator has a close check of the starting current, voltage, etc.

The ore is transported from the mine to the smelter, a distance of approximately four miles, by a cable way, which is driven by a 30 h.p. motor. The cable way goes over very rough country where the cost of building a railroad would have been excessive. It would also have considerably increased the operating expenses.

At the smelter there is a second sub-station with the necessary step-down transformers and a number of blowers and compressors for the operation of the converters. Besides these an a.c.-d.c. motor-generator set supplies direct current for the motors operating the converters, the cranes and similar machinery. The smelter has installed at the present time two converters which work up to their full capacity.

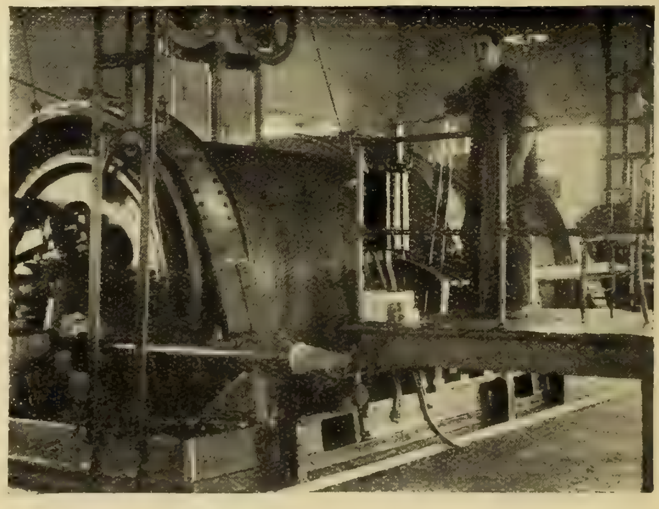


Fig. 3—Another view of double-drum mine hoist.

High Frequency Tests on Line Insulators

A paper was recently presented before the American Institute of Electrical Engineers by Mr. L. E. Imlay, superintendent of the Niagara Falls Power Company, and Mr. Percy H. Thomas, on the subject of high-frequency tests as applied to line insulators. The occasion for these tests arose when it was found desirable to raise the transmission voltage on a certain line from 22,000 to 38,000. Experience had shown that the old insulators occasionally punctured through the head from lightning, such failures being very difficult to locate. Further, this sort of failure was very unexpected in view of the fact that these insulators had never punctured under test though they would arc over when wet at about 90,000 volts, 25 cycles.

This discrepancy between the repeated punctures through the head from the conductor to the pin due to lightning and the immunity of the insulators to puncture on a 25 cycle test led to a systematic high frequency, high voltage test which is described in the paper. The tests in the laboratory were made to determine the difference in the behavior of insulators under a high frequency current and under a 60 cycle current.

The apparatus is illustrated and described in detail by which the authors were able to produce a current with a frequency in the neighborhood of 1,000,000 cycles per second or higher. The highest voltage obtainable along with this high frequency current was in the neighborhood of 300,000 to 350,000 volts. It is suggested in the article that while this voltage figure probably falls quite short of that experienced from a lightning flash, the figure for the cycles may have been comparable with that of lightning.

The tests made are outlined in detail but the general result may be expressed in a few words. It was found that under high frequency test, insulators in general punctured much more easily than under a 60 cycle strain. Often it was found that insulators which flashed over at a certain voltage with 60 cycles would puncture below the flash-over voltage under the high frequency test. Indeed, the paper states that the results showed most plainly that this resistance of the insulator to high frequency stress bore little relation to its strength against the normal 60 cycle stress. Also this was found to be true of insulators manufactured of different materials, electrose and porcelain being both subjected to similar conditions.

It is suggested by the authors, and a number of experiments were performed to verify this point, that the peculiar effect of a high frequency current is due to a different distribution of electric stresses produced under this condition, which distribution may be assumed to cause a concentration of potential at certain points. Following the description of the apparatus and tests the authors discuss the probable explanation of the observed results and draw certain conclusions, a resume of which is given below.

Discussion of Tests

"Unless there is some reason for believing that the tests are only of limited application or are rendered misleading by some unobserved condition, they mean that many of the line insulators now in service may be expected to break down by puncturing under the attack of lightning rather than by discharge over the surface, as is recognized as the desired characteristic. And this in spite of the fact that these insulators may have been thoroughly tested on normal frequencies in the usual way and may have then always flashed over the petticoats as intended. The fact shown in these tests, that an insulator which did not puncture at 250,000 volts on 60 cycles (under oil), punctured after a comparatively few shocks of high frequency discharge, and without apparently opposing a resistance of much over 100,000 volts, shows how little can be determined from the 60-cycle tests, as to the lightning resisting capacity of an insulator.

While none of the tests were on trains of suspension insulators, the question immediately arises whether the same effects, that is, local concentration of voltage with high frequency shocks, will not cause these insulator trains to puncture relatively easily from lightning even when withstanding satisfactorily the most severe tests of the usual sort. Such failure is very likely to be expected. High-frequency tests on such insulator trains should be made by all means, and without delay.

The conclusion also is forced upon us, that if high-tension line insulators are to be adapted to resist lightning to the best advantage, the design of many of them should be radically changed. Such a design study will require much patient investigation. In view of the importance of these conclusions, a critical examination of our tests was made for the purpose of discovering any improper methods or errors that might account for the great weakness of the insulators under high-frequency shocks; nothing, however, so far has been found to explain more than a very small portion of the very great discrepancy between the results of the two types of tests.

One very significant point is that no insulator failed on high frequency on the very first shock. In fact the strain of repeated shocks seemed to be far more severe than that of a few. Probably there is a progressive hammering out of a path through the solid material of the insulator. It will be immediately suggested, that this effect may be due to a progressive heating of the material by conduction or dielectric hysteresis, but we are inclined to doubt this. Investigations were made by exploring with the finger during the tests and, while after a puncture, which would of course be followed by some arcing, there was often a very noticeable rise of temperature at the puncture, exploration before an actual puncture but after the occurrence of many shocks showed no detectable preliminary heating. Furthermore, there seemed to be no difference in the behavior of electrose and porcelain. This matter of dielectric loss and heating is, of course, one of the matters that should be carefully followed up in future tests along these lines.

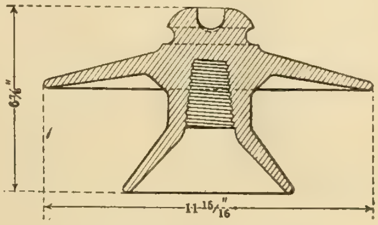


Fig. 1—Original Insulator

It has been suggested by some that porcelain deteriorates in quality with time or exposure to the weather. This hypothesis is supposed to explain the fact that insulators which stand up under tests and during the initial months of actual service then seem to fail far more readily at a later time. It is suggested by the behavior of the insulators of our tests that there was progressive deterioration under the intense stresses of these experiments (or under the attack of lightning in actual service), which while due to electrical forces are of a physical nature. This would be somewhat analogous to the well-known mechanical disintegration of the surface of glass under repeated surface sparking. In this view, the repeated attacks of these tests represent the anticipated effect of several seasons of lightning storms; to put it another way, the tests serve as a measure of the service durability of an insulator, as far as lightning and static are concerned.

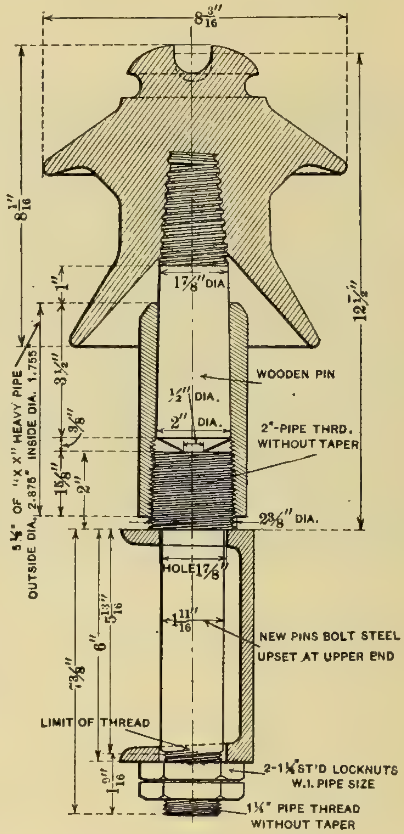
The probability of the trustworthiness of these tests is greatly increased by the behavior of insulators in actual service, where punctures of a surprising character have occurred at the time of lightning or other disturbance of a static nature. We are informed that trains of suspension insulators and also pin type high tension insulators which are carefully designed and shown by test at normal frequency to flash over before they puncture, still do in practice actually puncture under lightning strains. It is a fact, however, that many of these insulators at other times do actually flash over in actual service instead of puncturing under static stress, showing that either all insulators or all stress conditions are not the same. This matter cannot be finally cleared up without much experiment and research.

Of the most interest and importance is of course the explanation of the cause of the great observed discrepancy between the effect of high-frequency tests and commercial frequency tests. It is too early to speak with certainty, but there is little doubt that the principal cause is the concentration of potential with high frequency upon some local part of the insulating material with the result of the breaking down of this portion and the throwing of the potential on some other part which is then also broken down. This general phenomenon is well-known in related situations; for example, in the behavior of trains of small air gaps in high-tension lightning arresters.

If a resistance and a capacity are connected in series and so adjusted that a given voltage at 60 cycles is evenly divided between the two, and the same voltage at a much higher frequency is impressed on the two, it will be found that the resistance then receives nearly all the voltage and the condenser practically none at all. The same would be true to an even greater extent were an inductance substituted for the resistance. An adjustment may easily be arranged in which at 60 cycles the condenser will take all the voltage and at the high-frequency the resistance would take all the voltage. In applying this principle to insulator service, it must be remembered that the change in frequency between 60 cycles and the frequency of lightning is enormous, the ratio being somewhere of the order of 1 to 1,000 or 10,000, which gives range enough to permit even a small tendency of 60 cycles to be transformed into a dominating effect on the lightning frequency.

It will naturally follow from the conditions indicated by these tests, assuming that they are confirmed by later investigators, that it will be desirable to modify our methods of testing insulators for practical work by adding tests of their behavior on high frequency. Such tests presumably need not be made on all the individuals entering into a plant, but on each type, to show that the design is satisfactory. Such tests will be difficult to make, in the first place, because very high voltage and large capacity are necessary for making the tests, and second, because these tests are dangerous to the testing apparatus used and because so far there is no knowledge as to what limits of frequency, voltage, electrostatic capacity or number of repetitions of attack are necessary to give a proper measure of the conditions of actual service. These service conditions will undoubtedly vary greatly in different localities. It can be suggested here only that further study of these phenomena be made as speedily and as exhaustively as practicable.

In the matter of new designs of insulators to resist high frequency discharges, much research should be done, but there are some guiding principles already clear. First, the more widely the live conducting parts of an insulator are separated from the pin, the less will be the stress. Second, the more nearly uniform the electrostatic field between these elements is, the better the condition. Third, wide and thin petticoats add very little strength to the high-tension insulator, for the electrostatic capacity of the surfaces of the outer parts is very great with regard to capacity of the parts near to the pin. It is very likely that the capacity of the wide petticoat of the insulator of Fig. 1 plays little part in its behavior on high frequency, since the potential stresses may be transmitted through the petticoat by virtue of the capacity of the lower surface in relation to that of the upper surface. This would account to some extent for the behavior observed. It is significant that the type which stood best, had short and thick petticoats placed low down with regard to the pin top. The heavy ball of insulating material at and around the head of the pin is very likely the chief reliance of the insulator on high frequency. It will be noted that the design of the present suspension insulator has some points of disadvantage from the point of view of static stresses, if these tests are to be relied upon.


8 3/16"
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OUTSIDE DIA. 2.875" INSIDE DIA. 1.755
WOODEN PIN
1/2" DIA.
2" DIA.
2"-PIPE THRD. WITHOUT TAPER
2 3/8" DIA.
HOLE 1 7/8"
1 11/16"
5 13/16"
6"
7 3/8"
NEW PINS BOLT STEEL UPSET AT UPPER END
LIMIT OF THREAD
1 9/16"
2-1 1/4 ST'D LOCKNUTS W.I. PIPE SIZE
1 1/4" PIPE THREAD WITHOUT TAPER

Fig. 2—Section of Insulator Finally Adopted

Fig. 2 shows the insulator and pin finally adopted by the power company. The pin consists of an iron base for attachment to crossarm, and metal sleeve with conical bore to receive a wooden pin, which is secured in place by the pressure produced in screwing the sleeve and base together. The wooden pin is impregnated with bakelite to prevent absorption of moisture. No attempt was made to cement the pin in the insulator, but this can readily be done if experience indicates that it is desirable. The insulator thus mounted on the combination wood and iron pin will withstand a breakdown test at 60 cycles between a conductor in the tie-wire groove and the iron pin, of 120,000 volts, dry, and 85,000 volts wet. It is highly probable that if time had permitted a better design of insulator could have been developed, but the construction of a new line was under way and the order for insulators had to be placed."

Earthed vs. Unearthed Neutrals in A.C. Work

By J. S. Peck, M. I. E. E.*

The questions where, when, and how should the neutral point or points of an alternating-current system be earthed are highly controversial ones, and though they have been discussed a number of times before the technical societies, there are still wide differences of opinion among operating engineers as to the proper course to follow under different conditions. While it is difficult to give general rules covering all cases, there are certain conditions where the proper course to follow seems clear, and it is intended in this paper to discuss the various questions involved, and to show why under some conditions of operation it is becoming general practice to earth the neutral, while under others it may be advisable to operate with the neutral unearthed.

Three classes of apparatus or systems will be considered:

1. Generators.
2. High-voltage transmission circuits.
3. Low-voltage distribution circuits.

Before considering these three classes separately, the general advantages and disadvantages of the earthed neutral which are common to them all will be considered.

While several advantages may be claimed for the earthed neutral, there are but two which are really of any great value. These are:—

(a) The limiting of the voltage between line wires and earth.

(b) The possibility of cutting off any wire or feeder in the event of an earth upon it.

The chief objection to earthing is the fact that the system cannot be operated with an earth on any line wire.

It is well known that in an unearthed 3-phase system, where the impedance of each phase to earth is the same, each of the three conductors assumes a potential above earth equal to 58 per cent. of the voltage between wires while the neutral point is at earth potential, but any difference in the impedance causes the potential of the neutral point to shift bringing the phase having least impedance nearer to earth potential and raising the others to a potential correspondingly higher above earth. When one phase is earthed, it assumes earth potential, and the other phases reach full-line potential above earth. When the potential of each phase to earth is the same, the charging current to earth will be equal in all phases, but when one phase is earthed the charging current to earth is increased by 73 per cent. in both of the unearthed phases, and all of this current will return to the generator through the earthed phase and will pass into the faulty wire at the earthed point.

Earthing the neutral means that this point is fixed at earth potential, and the three-line wires are fixed at a potential 58 per cent. above earth.

If the neutral point is earthed through a resistance and one phase is earthed, current flows through the neutral resistance, and the drop across this resistance measures the voltage between the neutral point and earth, so that the neutral point is not fixed definitely but depends upon the amount of resistance and the current flowing through it. Thus the conditions are intermediate between those with the unearthed neutral and with the neutral solidly connected.

With the earthed neutral very simple and reliable apparatus can be provided, which will cut out any feeder in case an earth occurs upon it. This apparatus may be of the Merz-Price balanced protective type, or it may be of that type which is based upon the principle that the resultant current in a 3-phase circuit is zero. Fig. 1 shows a well-known arrangement of this kind. It is evident that under normal conditions the resultant current in the secondaries of the three transformers is zero, therefore no current can flow through the trip coil; but should an earth occur on one of the wires, the circuits will be unbalanced and current will flow through the trip coil. This apparatus may be adjusted to work on a very small earth current.

Still another possibility is to put a trip coil in series with the earth connection, but this arrangement is not so satisfactory as those previously mentioned, in that it does not discriminate as to the feeder to be cut off.

Where a large cable network is supplied from common busbars the arrangement shown in Fig. 1 may work satisfactorily without the neutral point being earthed. The reason for this is as follows:—

In the event of an earth on any wire, the charging current to earth on all of the cables on the system will be returned to the busbars through the wire which is earthed. Therefore the current balance on the earthed feeder will be upset and the circuit breaker operated. This arrangement is, however, limited to its application, and is not so positive as when there is a current flow between earth and generator neutral.

1. Generators

All modern 3-phase generators are insulated to stand operation without the neutral being earthed, so that no consideration of reduced first cost due to limiting the voltage to earth by earthing the neutral need enter the problem. Also the question of risk of breakdown with earthed or unearthed neutrals may also be practically neglected.

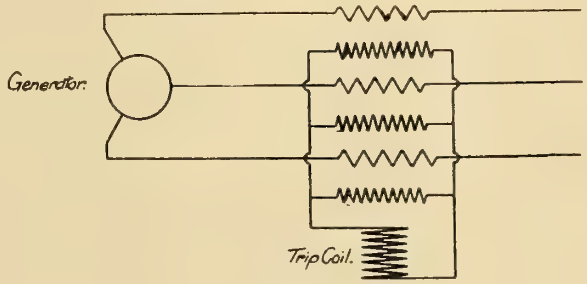

Fig. 1

When deciding upon the advisability or otherwise of earthing the neutral of a generator, consideration must be given to the service for which it is to be used. Three classes of service will be considered:—

(a) Generator supplying network of underground cables.

(b) Generator supplying overload transmission circuits without transformers.

(c) Generator supplying overhead transmission line through step-up transformers.

In case (a) an earth on any phase of a cable is almost certain to develop into a short circuit between phases, and on a large system the result of a short circuit on a cable is usually to burn off a section of the cable, perhaps to damage adjacent cables, and sometimes to set up surges which may cause serious breakdowns elsewhere on the system. Since the majority of breakdowns on cables are to earth, it is therefore extremely desirable that a cable be cut off as soon as an earth develops, and as this can be done quickly and with certainty where the generator neutral is earthed, it is becoming general practice to do this in all stations of this class. Thus practically the only question to consider is whether the neutral should be earthed solidly or through a resistance, and, where there are several generators in parallel, how many of them should be earthed. The only object in inserting resistance between generator neutral and earth is to limit the rush of current which occurs whenever there is an earth on the system. If balanced protective apparatus is used, similar to that shown in Fig. 1, the resistance may be made so high as to keep down the current rush to a comparatively low value, because the protective apparatus may be set to operate with a very small unbalancing in current; but where plain overload protection is used—and this applies to the majority of cases—the resistance should be low enough to pass sufficient current to trip the breakers on the largest feeder, but high enough to prevent damage to generator windings, and, if possible, to prevent serious burning at the point of accidental earth.

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*Presented before the Institution of Electrical Engineers,

In calculating this resistance, allowance should be made for the drop in voltage on the generator due to the load on one phase, also for the resistances in neutral earth connection in the feeder and at the point of accidental earth.

In designing the resistance, ample heat capacity should be allowed, for the circuit breakers may stick, or there may be at least temporarily a fairly high resistance at the point of accidental earth which will prevent the circuit breaker from opening immediately, and so give time for the resistance to reach a high temperature.

In general, earthing resistances are built up of cast-iron grids mounted on porcelain insulators, and should be located in a fireproof compartment. They are usually designed to have sufficient heat capacity so that full star voltage may be maintained across them for at least 15 seconds without a temperature rise of approximately 300° C. being exceeded. The ohmic value of the resistance is determined by the current required to trip the breakers on the largest feeder.

Earth Through a Resistance

Where it is desired to earth through a resistance, and two or more generators are operated in parallel, the simplest and best method in so far as earthing is concerned is to connect the neutral of all the generators to a common busbar which is earthed through a suitable resistance. Then, regardless of the number of generators, the value of the earth resistance will always be the same. With this arrangement switches must always be provided between each generator and the neutral busbar, otherwise a generator disconnected from the main bus and shut down may be raised to a dangerous potential above earth, in case of an earth on any feeder. The objection to this method of connection is that in certain cases very heavy currents may circulate through the neutral connections and generator windings, and while the deleterious effect of this current has been greatly overestimated, it appears in certain cases it has been almost impossible to operate with the neutrals connected solidly together. When the wave-forms of the different machines are exactly the same, no current can flow through the neutral connections, but when the wave-forms are different and there is a third (or multiple of three) harmonic present, current will flow through the neutral connection, the amount of which will depend upon the value of the third harmonic, the displacement angle, and upon the impedance which the generator offers to this current of triple frequency. Machines which at no load give no circulating current, may show heavy circulating currents as the load comes on, or vice versa. The amount of the circulating current also depends upon the adjustment of the field current of the different machines, and upon the angular variation in speed of the prime movers.

In certain abnormal cases the current in the neutral may amount to the full-load current of one generator or even more. It should be noted, however, that the neutral current divides equally among the three phases of the generator, so that full-load current in the neutral is equivalent to only 33 per cent. full-load current in the windings of the generator, and since the heating in the windings is equal to the sum of the squares of the main and circulating currents, the resultant heating is increased by only 11 per cent. —not a serious amount even with this very high value of circulating current. With 30 per cent. of full-load current in the neutral the resultant heating in the generator is increased by only 1 per cent. at full load and is quite negligible.

Connect Neutrals Solidly

It would seem advisable, therefore, to try connecting the generator neutrals solidly together, especially in the case of turbo-generators, where there is no angular variation in speed, and therefore less chance of circulating currents. Should satisfactory operation be impossible, then only one generator should be connected to the neutral bus, or resistance may be inserted between each generator and the neutral bus.

Of the three methods, that of connecting the neutrals solidly together is undoubtedly the simplest and best, while the method of operating with an earth on only one generator comes next in simplicity. The switching on and off of the different generators to the neutral bus may be done automatically, as at the London County Council Greenwich generating station, or it may be done by hand. While the latter method depends upon the memory of the station attendant, or upon the systematic operation of the station, the fact that the attendant may forget to connect a machine to the neutral busbar does not mean disaster, as it is only in case of a cable breakdown that trouble may occur, and it must be remembered that many stations are operating successfully with an unearthed neutral.

Where resistances are used between each generator and the neutral bus, a very considerable expense is involved in providing these resistances, and it is often difficult to find room in the station to accommodate them; also the resistance in the earth circuit is much less when there are several generators in parallel than when only one is in use.

(b) Generators supplying Overhead Transmission Line without Step-up Transformers.—In this case there are usually a comparatively small number of transmission lines, and an earth on one wire is not likely to cause a short circuit between wires, so that with an unearthed neutral it is quite possible to run for a long period with one wire earthed. If there are not sufficient feeders to all distributing centres to make it possible to cut out a defective one and deliver full load over the others, the possibility of being able to operate with one wire earthed may be sufficient far to outweigh the only practical advantage gained by earthing the neutral, which is the ability quickly to cut off a feeder in the event of an earth upon one wire. Limiting the voltage between each wire and neutral, which can be done by earthing the neutral, is of very little importance, since the voltage is no case very high, and the generators and the line must be insulated to withstand strains set up by lightning discharges and other abnormal conditions. It would appear, therefore, that in the majority of cases the weight of the arguments are in favor of operating with the generator neutrals unearthed.

(c) Generators supplying Transformers which Step Up to a very High Voltage for Long-distance Transmission.—In this case there are conditions involved which make it extremely desirable to earth the neutral or else to earth the low-tension side of the transformers.

If one terminal of the high-tension side of a single-phase transformer be connected to a high-tension line, and the low tension be open-circuited, the high-tension winding assumes a potential above earth equal to that of the line to which it is connected. The high-tension winding then acts as one plate of a condenser, with the low tension and core as the other plates. The low-tension winding also has static capacity to the iron, and it will therefore assume a potential above earth the value of which will depend upon the relation between its capacity to the high tension winding and its capacity to earth. In practice it may easily assume one-half the potential of the high tension winding (see Fig. 2).

If—

K = capacity between high tension and low tension.
K_1 = capacity between low tension and core.
V = voltage of high-tension line.
V_1 = potential of low-tension winding above earth.

$$V_1 = V \times \frac{K}{K_1}$$

If both terminals of the high-tension winding are connected to the high-tension lines, the resultant potential of this winding above earth will be zero, and the resultant potential of the low-tension winding above earth will also be zero. If, therefore, one terminal of a transformer be connected to or disconnected from a line before the other, the low-tension winding during this period may assume a very high potential above earth and its insulation be broken down to earth. When the low-tension winding is connected to a generator, the generator winding also has capacity to earth, so that the capacity of the low-tension winding to earth is increased by this amount and its voltage correspondingly reduced. If the capacity of the generator winding to earth = K_2, then the voltage of the low-tension circuit above earth = $V \times \frac{K}{K_1 \times K_2}$. Thus, while the voltage is reduced by connecting the transformer and generator windings together, it may still be dangerously high.

When both terminals of the high-tension winding are connected to the line and one wire is earthed, the resultant voltage of the high-tension winding above earth will be $V/2$, and that of the low tension winding will be one-half as great as before, but may still be dangerously high.

In the case of a 3-phase transformer the conditions are much the same as described above for a single-phase transformer. If one terminal of the transformer is connected to the line, the whole of the high-tension windings will be raised to full-line potential above earth, and the low-tension winding will be raised to a correspondingly high value. If the three terminals of the high-tension winding are connected to the line and one line wire be earthed, the resultant potential of the high-tension winding will be 58 per cent. of the line voltage above earth, while the low tension will be 58 per cent. of its former value above earth.

It is evident that when the neutral of the high-tension system is unearthed there are several possibilities of obtaining a high voltage on the generator windings, viz., in the case of an earth on one high-tension wire, or in the case of the switches in the three phases not operating simultaneously. It is not necessary that a line wire should be permanently earthed in order to raise the voltage on the low-tension circuit, as a discharge over a lightning arrester may so disturb the static balance of the system as to produce a high potential on the low-tension winding.

A case is on record where several generators in parallel were supplying a very high-voltage line through step-up transformers. The neutral point of the generators was unearthed. The lightning arresters on one high-tension phase broke down and the generator windings were raised to a high potential. One generator broke down, and the attendant, seeing smoke, cut it off the busbars. A second machine immediately broke down, and was in turn cut off. This was repeated until nearly all the generators in the station were broken down. The attendant then cut off the excitation. Had the neutral point of the generators or that of the high-tension side of the transformers been earthed, the trouble could not have occurred in the generator circuit. There is, however, a chance of similar trouble even when the high-tension neutral is earthed, provided the generator neutral is unearthed. This occurs when the insulation between the high and low-tension windings of the transformer breaks down at one point. The low-tension winding then assumes the potential of the high-tension winding at the point of connection, and a breakdown on the low-tension system is almost certain to follow.

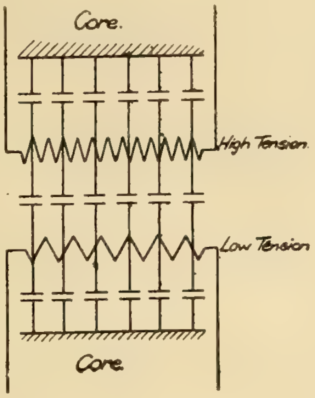

Fig. 2

With electrolytic lightning-arresters it is necessary to connect the aluminium plates to the lines at frequent intervals in order to preserve the film on the plates. These plates have a high electrostatic capacity, and a considerable charging current flows through the arrester while it is connected to the line. It has been found on one system that when the arresters are being charged, disturbances are set up on the system and breakdowns have occurred on secondary circuits. It is quite possible that this trouble is due to the static unbalancing of the high-tension circuits, which in turn raises the secondary circuits to a high potential above earth.

Where it is considered undesirable to have a direct connection between low-tension windings and earth, a spark-gap may be placed in the circuit and set to break down at a pressure slightly above the normal voltage of the winding above earth.

Another method of protecting the low-tension system in the case of breakdown between the windings of the transformer is the use of earth shields between primary and secondary windings. This system was at one time in general use in this country, but it is now scarcely ever called for. The objections to it are:—

(a) Increased transformer cost.
(b) Increased risk of transformer breakdown.
(c) No protection when breakdown is between leads or anywhere except between transformer coils.
(d) The danger that earth shields may become displaced.
(e) The leads connecting earth shields to core may be broken due to vibration or to settling of core and coils, or they may be burned off due to heavy charging current which may flow over them.
(f) Part of earth shield in the neighborhood of fault may be burned away and leave primary and secondary windings connected together with no earth on the system.

While it may be argued that many of these difficulties are due to defective manufacture, and should not occur provided proper precautions are taken, there is always the possibility that they may occur, and the practical impossibility of inspecting the earth shields after the coils are assembled makes it almost impossible to determine their condition.

Thus in the case of generators supplying a high-tension transmission line through transformers, it is highly desirable to earth the neutral point of the generators, and preferably through a rather low resistance. If it is not desired to connect permanently to earth, then a spark-gap should be used in the earth connection.

2. High-voltage Transmission Circuits

The arguments in favor of earthing the neutral in the case of high-voltage transmission circuits are:—

(a) The possibility of cutting off the circuit in case of an accidental earth on any wire.

(b) Reduced cost of transformers and of line insulators due to limiting the voltage above earth to 58 per cent. of line voltage.

(c) Reduced cost and closer possible setting of lightning arresters.

(d) The possibility of using the earth as a conductor in the event of one line wire being disabled. This requires an earth at both ends of the line.

The argument against earthing the neutral is that an earth on one wire makes it impossible to transmit over the circuit.

(a) Whether there is any advantage in being able to cut off a circuit in the event of an earth on one wire depends upon the number of circuits available. In general, there are seldom more than two circuits to any sub-station, and often there is but one, so that cases may often arise where, to keep up the supply, it will be absolutely necessary to operate with one wire earthed. This method of operation would be impossible with an earthed neutral. Also an earth on one wire is not likely to develop into a short circuit between phases, so that there is no particular need for cutting off the earthed circuit.

(b) The higher the voltage of the transmission the greater will be the saving in first cost made by insulating the transformer for 58 per cent. of the line voltage and by using the line insulators for a corresponding voltage; but in general it is bad practice to adopt this expedient, for it may prove impossible to operate continuously with an earthed neutral, due to disturbances on adjacent telephone circuits which may occur under certain abnormal conditions, and in the event of an earth on one wire it may be essential to remove the neutral connection and operate with one wire earthed. In general it is poor economy to cut down insulation on either lines or transformers.

(c) If the system may sometimes be operated without earthed neutral the lightning arrester equipment must be suitable for this condition, so that there is no saving in first cost; but as long as the system is operating properly with earthed neutral the arresters may certainly be set for lower discharge values than when the system is unearthed.

(d) In the event of one wire on an earthed system going to earth, it would still be possible to transmit approximately two-thirds the full amount of power over the two remaining wires, provided the neutral points at both ends of the line were solidly earthed and one line with its corresponding transformers cut out of circuit. In this case the earth would carry full-line current, and in very few places would this be allowed on account of disturbances to neighboring circuits.

The neutral point of a high-tension system can be obtained only by connecting the high-tension windings of the transformers in star, or by the use of an auto-transformer, and this latter method is seldom if ever used. If the high-tension windings are connected in star, then damage to one transformer disables the whole group, while with the delta connection on both windings one transformer of the group may be cut out and approximately two-thirds the capacity supplied from the remaining transformers. (This does not hold in the case of 3-phase core-type transformers, but is true for single-phase and 3-phase shell-type transformers).

The conclusions to be drawn from the above are that in the great majority of cases continuity of service will demand that the system be operated with an unearthed neutral, and that in general the transformers should be connected in delta on both high-tension and low-tension windings.

3. Distribution Circuits

When it comes to a study of the question of low-tension distribution circuits, the majority of the arguments presented above will apply here also, but there enters one other consideration, i.e., the danger to human life.

If the neutral point of, say, a 500-volt system is earthed, then the maximum potential above earth which any point of the system can reach is 290 volts. If the system is supplied from a 500-volt generator, the difference between a 500-volt and a 290-volt shock may mean the difference between life and death, or it may not, and there is certainly greater risk of shock from a system which is permanently earthed than from one which is earthed only occasionally. The higher the voltage of the generator the less will be the value of the earthed neutral in preventing danger to life due to reducing the voltage to earth.

Thus, where the distribution circuit is supplied direct from a generator, the advantages of the earthed neutral are the ability quickly to cut off a defective circuit and a possible reduction in risk of life, due to lower maximum voltage to earth; but where the circuit is supplied through step-down transformers from a high-voltage line, there is danger to life and apparatus if the neutral is unearthed.

Where a single-phase circuit is supplied from a single-phase transformer, the low-tension winding should be earthed, preferably at the middle point of the winding, but it is better to earth one line wire than to leave the system unearthed.

Conclusions

1. Generators.—When generators supply a system of underground cables, the neutral should be earthed through a resistance. This makes it possible to isolate a cable in the event of an earth on any phase before such an earth develops into a short circuit.

When generators supply overhead circuits, it is a question of balancing continuity of service against the ability to cut off a feeder in case of an earth upon one wire. If there are comparatively few feeders, and these of large capacity, the balance will usually be in favor of not earthing, but each case must be considered individually.

When a generator supplies transmission lines through step-up transformers, the neutral should always be earthed or connected to earth through a spark-gap, otherwise the generator windings may be raised to abnormally high potential above earth. The neutral may be earthed direct, though a comparatively low resistance will usually be preferred.

2. High-voltage Overhead Transmission Lines.—In this case the number of circuits supplying any particular district is ordinarily very small, and as an earth on any one wire is not likely to develop into a short circuit between phases, considerations of continuity of service will usually determine that the high-tension system should be run without an earthed neutral and with both windings of the transformers connected in delta.

3. Distribution Circuits.—When the working circuits are supplied direct from a low-voltage generator, the advantage in earthing the neutral is the possibility of cutting off immediately any defective feeder, and when the necessary apparatus is provided for this purpose earthing will in general be preferred.

When the working circuit is supplied from a transformer stepping down from a high-voltage line, the neutral should always be earthed.

Possible Heat Economies in the Boiler Room

By Mr. A. H. Blackburn*

The first step toward improvement of steam plant economy is an analysis of losses. The largest item of power plant expense is the fuel bill, and at the very beginning of the process of utilizing the fuel, we encounter one of the greatest percentage losses. To burn each pound of fuel, from 18 to 24 lbs. of air are, or should be, introduced into the furnace to bring about complete combustion and to set free the 12,000 to 14,000 heat units that the pound of coal may contain. Assuming that 20 pounds of air are used and that to heat each pound of the gases of combination one degree Fahrenheit will require 0.23 heat units, the gases resulting from 1 lb. of coal require 20 x .23 = 4.6 heat units to raise their temperature 1°F. and 12,000 to 14,000 heat units would raise the temperature of this gas approximately 2,500 deg. F. The temperature in the furnace after complete combustion should therefore be about 2,500 deg. F. above the temperature of the atmosphere.

The temperature of steam at 150 lbs. gauge pressure is 366 deg. F., and if all the heat in the gases above this temperature could be transferred to the water and steam of the boiler, the efficiency of the boiler, assuming an atmospheric temperature of 60 deg. F., would be 88 per cent., leaving only 12 per cent. of the heat of the coal to escape in the chimney gases at a temperature of 366 deg. F.

As a matter of fact, however, no boiler reduces the temperature of the gases to the temperature of the steam. To do so would require an infinite extent of heating surface, for as the temperature of the gases approaches that of the contents of the boiler, the rate of heat transmission per sq. ft. of boiler surface falls lower and lower, as it is proportional to the difference of temperature between the gases and the water in the boiler. There is, therefore a limit to the boiler surface that it pays to put in. Beyond a certain point the interest and other fixed charges on extra boiler surface would amount to more than the value of the heat regained. Commercial practice has established this limit of surface at about 10 ft. per boiler h.p., but experience shows that a h.p. can be produced from much less surface—from 3 to 5 sq. ft. or even less—and in some plants it is becoming customary to drive the boilers at 60 per cent. above the nominal rating of 10 sq. ft. per boiler h.p. It should be borne in mind that the question of heating surface has, in reality, nothing to do with the steam liberating capacity. No matter what the extent of the heating surface the boiler must have large enough steam drums or other provision to separate the steam from the water without priming.

With the number of sq. ft. of boiler heating surface ordinarily employed to produce a boiler horse power, it will be found in commercial plants that the chimney gases escape at temperatures between 450 deg. and 700 deg. F., representing a waste of from 15 to 30 per cent. of the heat of the coal, depending partly upon the amount of air used to burn a pound of coal. In a 1,000 h.p. plant, running 24 hours a day for 360 days per year, with a load-factor of 50 per cent. and burning coal, costing $2.50 per ton, a 25 per cent. waste of coal amounts to $6,000 a year, not counting handling charges, and it will therefore pay to study how it may be wholly or in part prevented. This problem has engaged the attention of steam engineers from the first, and many solutions have been proposed.

Chimney gases can obviously be used only for heating boilers at a temperature lower than themselves, and in order that the transference of the heat from the gases may be rapid enough to make it worth while, the body receiving heat should be at a considerably lower temperature. The contents of the boiler are at too high a temperature to utilize this heat. The most available means for utilizing this energy is in heating feed water. To burn a pound of water at 60 deg. F. into steam at 150 lbs. gauge pressure requires 1166.5 heat units, of which 309.7 are consumed in heating the water up to the temperature of ebullition, namely, 366 deg. F., while the remaining, or 856.8 heat units, are used in turning the water into steam at the same temperature. The heat required for merely heating the water is thus 26 per cent. of the whole, which, as will be noted, is about equal to the percentage of the heat of the coal present in the flue gases when they escape from the furnace.

It may be asked why it is not possible to feed the water into the boiler cold and to allow it to re-capture this waste heat from that position. Aside from the injurious strains set up by feeding a boiler with cold water, there is another important fact that must not be overlooked, and that is, that the transmission of heat from the gases to the water is proportional to the difference between the temperature of the two, and if we can bring the cold water before it has entered the boiler, into contact with the hot gases it will absorb the heat much faster through 1 sq. ft. of heating surface than it will if we put it into the boiler and allow it first to mingle with and be warmed by the large body of hot water there present. Obviously, the feed water should be heated in a vessel separate from the boiler and receiving gases of combustion after they have passed through the boiler. This is the correct application of the counter-current principle to boiler practice.

The Economizer

The problem of devising an efficient apparatus for this purpose was first taken up by Edward Green, of England, in 1845. After experimenting with a great many types of apparatus and with different arrangements and kinds of tubes, he finally settled upon an arrangement substantially identical with that now in general use. This apparatus, well named by its inventor, the Economizer, consists of a stack of vertical cast iron tubes, each about 4⅝ inches in diameter and 9 feet long, pressed into top and bottom headers to form sections of the desired number of pipes, which sections are in turn placed side by side to form an economizer of any desired length and capacity. Ordinarily, the water is introduced to the bottom headers by a branch pipe running along one side of the economizer and the hot water is taken from the top headers by another branch pipe running along the diagonally opposite corner of the assembled economizer. The amount of economizer surface that should be installed in any given case can only be determined after a careful consideration of many factors, including the amount of fuel burned, the size and type of the boilers, cost of the coal, load-factor, etc. A general practice is to install half as much economizer surface as boiler surface, but where the boiler surface is driven considerably above the ordinary commercial rating, this would be too little.

The size of economizer required to effect a given result, may, however, be easily calculated with fair accuracy. Suppose that the temperature of the water entering the economizer from the hot-well of the condenser is 105 deg. F., and that the final temperature desired is 260 deg. F., or a total rise of 145 deg. F. Suppose, further, that the temperature of the gases leaving the boiler is 600 deg. F. Now say that 10 lbs. of water are evaporated per lb. of coal burned and that 20 lbs. of gases are discharged for each pound of coal, giving 2 lbs. of gas per lb. of water. Assuming the specific heat of the gases to be .23, it will be seen that for each degree rise of the temperature of the feed water, the gases will be cooled off a little more than 2 deg. F., so that the total fall in temperature of the gases will be 2 x 155 = 310 deg. 600 deg. — 310 deg. = 290 deg. F. is, then, the final temperature of the gases leaving the economizer. Now a boiler horse-power is represented roughly by the evaporation of 30 lbs. of water per hour. To heat 30 lbs. of water through 155 degs. will require 4650 heat units, so we must install enough economizer surface for each boiler horse power to transmit 155 heat units per hour when the average temperature of the gases is $\frac{600 + 290}{2} = 445$ deg. F. and the average temperature of the water is $\frac{105 + 260}{2} = 182.5$ deg. F., that is, when the average difference between the gases and water is 445 deg. — 182.5 = 262.5 deg.

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* General Manager, the Green Fuel Economizer Co.

Extensive experiments have shown that the amount of heat transmitted through an economizer surface per sq. ft. per hour per degree difference of temperature Fahrenheit is from 2½ to 4 British thermal units. Taking 2½ to be on the safe side, we find that in the above case each square foot will transmit 262.5 x 2.5 = 655 heat units per hour and to transmit 4650 heat units per hour will require $\frac{4650}{655} = 7$ sq. ft. of economizer surface.

To illustrate the foregoing remarks I will refer to the performance of several economizers installed in well-known plants. Dean and Main, consulting engineers, of Boston, made tests some time ago on the Green fuel economizer installed in the Natick Mills in connection with a B. & W. boiler, having 3,467 sq. ft. of heating surface. During the test a steam pressure of 150 lbs. gauge was carried and 10.216 lbs. of coal were burned during a period of 11¼ hours, converting 94,734 lbs. of water at 40 deg. F. into steam at 150 lbs. pressure gauge. The temperature of the gases leaving the boiler was 416 deg. F., an exceptionally low figure, while the temperature of the water leaving the economizer was 165 deg. F. The conditions here would usually be considered unfavorable for a large showing by the economizer, since the gases leaving the boiler are comparatively low in temperature. By comparing the results obtained with the economizer with an identical test made two days later without the economizer, it was found that the coal saving, as represented by the lbs. of water evaporated per lb. of coal, was nearly 14 per cent., although the difference of the feed temperature would have given only 10.8 per cent. increased evaporation by the common rule of 1 per cent. for each 10 deg. rise. This brings to our attention a fact very often encountered in the comparative economizer tests with and without the economizers, namely, that the actual coal saving is greater than would be computed from the ratio of the heat supplied by the economizer to the total heat required to turn the water into steam. Several explanations of this fact have been attempted, the most likely of which is, that by furnishing part of the heat the economizer diminished the work of the boiler heating surface and the amount of coal that is burned upon the grates, and it is known that boilers and furnaces as ordinarily installed fall off slowly in efficiency when the load is increased beyond a certain amount. By the installation of suitable means of burning efficiently the larger amount of coal upon the grate this relation might be changed, but the fact that the actual coal saving is greater than the theoretical has been frequently noted in tests. Results in other plants are shown in the following table:

Test No.	Boiler surface sq. ft.	Econ surface sq. ft.	Steam pressure lbs.	Temp. F. flue gases leaving boiler	Temp. F. water entering econ.	Temp. F. water entering boiler	Saving %
1.	3,126	1,920	68.2	435	84.2	196.2	12.5
2.	9,000	11,520	120.3	620	101.	237.	18.3
3.	33,380	98,340	166.	548	96.	200.	9.2
4.	14,000	4,608	150.7	389	103.	202.7	12.4
5.	9,543	4,749	78.2	535	184.5	265.2	

In none of these plants, as will be noted, were the gases from the boilers at a particularly high temperature. When high temperature gases are available, much greater savings can be realized by the economizer, as will be apparent from the results secured in the following plants. At the Daubhill Brickworks, Bolton, the average flue temperature was 650 deg. F. The economizer raised the feed temperature from 52.1 deg. F. to 259.5 deg., thus saving 21 per cent. of the coal. At the works of Dickens and Haywood, Middleton, the temperature of the flue gases was 655.25 deg. and the economizer was able to raise the feed from 59.6 deg. to 301 deg., saving 24.7 per cent. At the mill of A. Scott & Sons, Oldham, the temperature of the flue gases was 721.6 deg., the feed was raised from 50 deg. to 291 deg. and the saving was 26.18 per cent. At the Manchester Union Warehouse, a flue temperature of 675 deg. was found, which made it possible to raise the feed from 113.3 deg. to 282 deg., giving a saving of 20.2 per cent. The economizer in the plant of A. Scott & Sons, contains 216 tubes, and as the plant burns over six tons of coal per day of ten hours, the economizer more than pays for itself every year.

It should be pointed out in this connection that modern practice is inevitably in the direction of higher temperature of the gases leaving the boiler. Steam pressures are constantly being carried higher, and as the boiler cannot in any way reduce the temperature of the gases below nor even anywhere near the temperature of the steam, the temperature of the flue gases will rise in consequence. For instance, with a boiler pressure of 200 lbs. gauge the temperature of evaporation is 387.5 deg. F., under which condition the temperature of the gases leaving the boiler will probably be well above 500 deg. F. Where a superheater is employed in connection with the high pressure, a good arrangement is to place the superheater in a by-pass for the gases, thus securing along with a convenient and safe location of the superheater, a low final temperature of the chimney gases and high fuel economy.

So far we have dwelt entirely upon the fuel saving effected by the use of economizers, but there are several minor advantages which should be mentioned. For one thing, it increases the steaming capacity of the boiler, that is, by supplying 10, 15 or 20 per cent. of the heat required to turn the water into steam, it permits the boiler to evaporate that much more water without increasing the virtual rate at which the boiler heating surface is driven. This feature is especially important in plant subject to sudden and very heavy overloads, in which case the boiler is still further aided by the fact that the economizer holds in reserve a large supply of hot water. Where 5 sq. ft. of economizer surface per boiler horse-power are installed, this supply of feed water, heated up nearly to boiler temperature, is sufficient for about an hour's run. The protection given to the boiler in the way of avoidance of straining of seams and rivets through heating the feed water is well recognized, since it is known that if the cold water discharge upon one portion of a boiler shell should reduce its temperature by 170 deg. F., the stresses set up would be in the neighborhood of 30,000 lbs. per sq. in.

ELECTRIC RAILWAYS

Trunk Line Electrification*

By Mr. N. W. Storer

The supplying of motive power is one of the most important elements of railway transportation. For many years the steam locomotive had a complete monopoly of the business and, like some other monopolies, it lacked the incentive of competition. Since the electric locomotive entered the field, however, there appears to have been a great awakening among steam locomotive designers. The improvements in the steam locomotive, such as mechanical stokers, superheaters, smoke consumers, etc., have led to the production of the enormous units that are now standard. These great machines have produced such excellent results that the electric locomotive no longer has such comparative advantages as were apparent even ten years ago; and, while the electrification of a large part of our railways will undoubtedly be accomplished at some time, the improvements in steam locomotives have removed the crying necessity for it, except in special instances. It would be a great mistake to compel the railways to electrify too rapidly; it would be far better for them to study the subject with the greatest care, and finally to unite on the best system and then proceed with electrification in places where there will be distinct economical advantages. In large cities especially, it is of the utmost importance that the railways unite and give every plan most careful consideration before starting actual work.

The manufacturing companies have done a tremendous amount of work in developing the various systems of electrification, and in the design of electric locomotives. They have learned many things about locomotives. They have found that low center of gravity in the electric locomotive, instead of being an advantage, is a decided disadvantage. They have also found that because an electric motor develops its power by rotation it is not necessarily easy for it to turn the wheels of a locomotive. For some years it has been recognized that one of the greatest problems in the electric locomotive is the transmission of the torque of the motor to the driving wheels. There have been a great many combinations proposed and quite a large number of different types have been built, and are now in operation, but there are few transmission systems that are absolutely satisfactory from all points of view.

In this respect, as in most others, every design is a compromise among the conflicting elements, not simply in the locomotive itself, but on the roadbed and shop as well. It is recognized that, in proportion as a locomotive is built up around one idea in its design, it will be distorted, and other things will be neglected. It is, therefore, necessary that a careful study of the entire problem of railroading be made in order to produce the best type of locomotive. Progress in heavier railway electrification is analogous to that of the development of street railways. The early forms of railway motors and controllers were designed, to a great extent, in the laboratory; but as time went on the designers became more and more imbued with the spirit of the operating man and with the problem in general, and from the constant association with those men and the study of the problems in the field, they developed street railway motors and controllers to their present high state of perfection. The same plan should be followed in connection with the electrification of railways. The best locomotive is the one that will deliver the transportation required of it with the lowest sum total of expense. This must include not simply the first cost and cost of maintenance and depreciation of the locomotive itself, but the first cost and cost of maintenance, depreciation and operation of the entire installation from power house to roadbed.

The standard type of single reduction geared motor has been eminently satisfactory for street car service, but the difficulties connected with it have increased enormously as the power of motors and speeds have been increased, until to-day it is considered poor practice to gear locomotive motors directly to the axles, except for slow-speed work. Several reasons have contributed to this belief:—

1.—The gears are subject to very severe service when run at high speeds and rigidly connecting so much inertia as is contained in the wheels and armatures, and to still greater shocks from the roadbed. In the operation of high speed railways using single cars or multiple-unit trains, there has always been more or less trouble from gears with speeds around fifty and sixty miles an hour. The gears and armatures both suffer and there is always a great increase in the cost of operation, especially if the track is poor. The motor on one axle is subjected to worse punishment than that on the other. The trailing axle has the pinion of the motor pushing downward on the gear teeth, and the other axle has it pushing upward. The motor whose pinion is driving downward usually fares much worse both in gears and in the armature windings, due to the blows that it gets from the roadbed. When a wheel comes to a depression in the track, it is suddenly lifted as it climbs out, and gives a direct shock to the teeth of the gear, that tends to retard the whole armature.

2.—The weight of the motor on the axle, and its low center of gravity, contributes to serious injury to the track when operated at high speeds. Chiefly for these reasons, the speed of most locomotives, having heavy motors geared directly to the axles, is limited to about thirty miles per hour.

This geared type of locomotive is comparatively simple, cheap and easy to maintain, but when the design of a locomotive for high speed service is considered, the problems to be solved are many and difficult, and the solutions that have been offered are almost as numerous. It is, of course, comparatively easy to design motors that are sufficiently large and powerful to equip any locomotive that is desired. The big question is, how to connect the motors to the driving wheels so as to give a locomotive that will have a reasonable cost of maintenance and, at the same time, be a good riding machine.

There are several general types of high speed locomotives:—

1.—Those with armature mounted rigidly on a driving axle.

2.—Those with motors mounted on a quill surrounding the axle.

3.—Those with motor geared to quill surrounding axles, and connected to wheels through long helical springs.

4.—Those with motors mounted in the cab and driving through a jack shaft and a system of parallel rods.

5.—Those with motors mounted low between frames and connected to the drivers through a Scotch yoke.

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*From a paper read at a recent annual convention of the Association of Railway Electrical Engineers, Chicago.

6.—Those with motors connected to the wheels by some combination of gears and side rods.

1.—Armatures on Driving Axles

The first type, known as the New York Central type, may be called an example of a locomotive built around one idea, namely, that of mounting the armature of the motor directly on the axle, and building the motor field into the truck frame so as to do away with all motor bearings. It is a scheme that is ideal in its simplicity, and it is not surprising that the New York Central desired to use it. However, it is well known that the locomotives have never been considered as successful high speed machines, on account of the tendency to nosing. Many steam locomotives have some tendency to nosing, but it is not serious, as the mass of the locomotive is located so high above the rail. This type of electric locomotive has an extremely low center of gravity, so that it is quick to feel the irregularities in the track, and synchronous vibrations are very easily set up. A great deal has been done to eliminate this defect, but the efforts have been only partially successful.

2.—Armatures on Quills Surrounding Axles

This type, first used on the New Haven passenger locomotives, has the motors mounted on quills surrounding the axles and connected through springs, and is open to some of the same objections as the first type. It also has a low center of gravity although considerably higher than the first type, but all weight is spring-supported so that the track does not get a direct blow. The original New Haven locomotives nosed at high speeds, but this was cured by the addition of idle wheels at each end of the locomotive and a toothed cam centering device between the cab and the trucks. However, even with the motors carried by springs, the track is liable to damage unless it is kept in good surface.

3.—Motors Geared to Quill

The third type is one of the latest developments, and the New Haven and Boston & Maine locomotives of this type are the easiest riding electric locomotives that have been built. Mounting the motors rigidly on the trucks above the axles and gearing down to the quills of course raises the center of gravity very considerably. Then the long helical springs connecting the quills to the driving wheels permit the axles and journal boxes to move a total vertical distance of three inches in the pedestal jaws, before the quills touch the axles. Then the wheels are free to follow the inequalities of the track without disturbing the mass of the locomotive, and consequently with the least possible damage to the track. The arrangement of wheels, combined with the distribution of weight and the drive, entirely prevents nosing, and the secondary springs, transmitting the weight of the cab to the trucks through the large surface plates, prevent the transmission of vibration from the truck frame to the cab.

This type of locomotive has been built, both with a single motor per axle, and with twin motors of the same total capacity per axle. After building a number of the former, whose motors were so large as to require double gears, it was found that the same output could be obtained, with less weight and less cost, by substituting two motors for the one large one. This arrangement has the following advantages:—

(a) Only one gear is required, as both motors drive through the same gear.

(b) The two motors are lighter and easier to handle, and cheaper to maintain than the large one.

(c) The motors in this case may be made interchangeable, except field casting, with the motors used on multiple-unit cars.

(d) Two motors permanently connected in series give in effect one motor of double voltage and consequently half current. This reduces the carrying requirements of cables and switches to one-half, and thus makes a substantial saving in the cost of control equipment.

The spring drive eliminates the bad effects of the impact of the teeth when operating at a high speed, so that it is anticipated that the gear speed may be much higher than that of ordinary gears mounted directly on the axles.

While these locomotives are now built for single-phase operation, they would have practically the same advantages on direct current. The twin motor scheme adapts itself well to high voltage direct-current operation.

4.—Motor Mounted in Cab

The fourth type of locomotive has a very high center of gravity and, although the weight on the driving axle is about 56,000 lbs. and the springs are consequently stiff, the locomotive has excellent riding qualities. There is no tendency to nosing, and no bad effects on the track. The first locomotives of this type were those for the New York terminal of the Pennsylvania Railroad. These are the most powerful electric locomotives ever built, and have a record for the first year, with 33 locomotives in service, of 13 train minutes delay chargeable to the locomotive. They have developed over 75,000 lbs. tractive effort at the draw-bar. This corresponds to a crank-pin pressure of over 100,000 lbs. Of course, the normal pressure on crank pins is not nearly so high, but it is sufficient to impose strains on the jack-shaft bearings that are very hard to hold. These strains are worse than on reciprocating engines. There is scarcely any neutral zone, because of the combination of strains imposed upon it by the motor rods and driving wheel rods acting at an angle of about 45 degrees from each other. This angle, however, is much to be preferred to the vertical motor rods adopted for the first locomotives built for the German State Railways. These were practically failures, and it is understood that future locomotives will have motor rods similar to those of the Pennsylvania.

The use of side rods on an electric locomotive introduces some different problems from those found in the steam locomotive. As there are no reciprocating parts, such as piston rods, the parts are susceptible to perfect balance. The rods must be much larger than for corresponding steam locomotives, because the entire power has to be transmitted through one set of pins and rods at certain points in the revolution, while the steam engine transmits the power from only one cylinder. The steam engine has another advantage in that the main rods on the two sides of the locomotive are connected to loose ends (pistons), while the rods on the two sides of the electric are connected to opposite ends of the motor shaft, as well as the jack-shaft, which introduces a great many chances for inaccurate workmanship and consequent knocking in the pins and bearings.

5.—Motors Low Between Frames

The fifth type of locomotive has been used exclusively for the three-phase locomotives on the Italian State Railways. The first ones have been in service some ten to twelve years on the Valtellina line, and have given excellent results. The later ones, some 35 in number, have been used about two years on the Giovi line near Genoa, These machines have some excellent qualities, light weight, powerful motors, and motor weight entirely spring supported. They have, however, been used only in slow and moderate speed service, so their performance at high speed remains to be proven. These locomotives also require very accurate adjustment, although not so close as the ones with side rods and jack shafts, as the Scotch yoke drives one axle through a sliding block and the others through parallel rods connected to the yoke by knuckle pins.

6.—Motors Connected by Gears and Side Rods

A number of locomotives of this kind have been put in service, the most notable being those built for the Loetschberg Tunnel in Switzerland, and for the Midi Railway in France. The former has two 1,000 horse-power motors, each connected by a helical tooth gear to a jack shaft, which is slightly above the driving axles, and thence by parallel rods, to three pairs of driving wheels. Although the motor speed is extremely high, the gears operate practically without noise and with high efficiency. The duty on the jack shaft bearings is much easier than when side rods only are used, since the reciprocating pressures are practically all in a horizontal direction, and can therefore be cared for much more easily. The Midi locomotive has two motors, each geared to a jack shaft through gears located outside the plate frames of the locomotive. The jack shafts are connected to the drive wheels through Scotch yokes, like the Italian locomotive. Either of these types has fairly high center of gravity and is therefore susceptible of a design that will have excellent riding qualities.

Any of the types of locomotives described, except the New York Central type, might be equipped with apparatus for any of the known systems. The New York Central type is suitable for direct current only. The New York, New Haven & Hartford locomotives, of both types described, are operated with single-phase alternating current motors on both alternating and direct-current circuits. The Pennsylvania locomotive is for direct current, but locomotives of similar type are built in Germany for single-phase lines. The Italian locomotives are all for three-phase operation. The combination gear and side rod locomotives are both equipped for single-phase operation.

While most of these locomotives are equipped with alternating-current motors, this is only because it has been believed that alternating current is better suited for heavy trunk line electrification.

Other Considerations in the Choice of a System

If the choice of system rested only on the locomotive, undoubtedly the standard 600 volt direct-current system would be chosen in the large majority of cases as being the simplest and best adapted for the work. But for the electrification of trunk line, this is an economic impossibility, because with the low voltage, too great an expenditure for substations is required and a low efficiency results except with a traffic which gives a good load factor. Third rails must be used on account of the enormous currents required.

In order to reduce the number and cost of sub-stations, the voltage must be increased to a point that would prohibit the use of a third rail, even if it were not otherwise undesirable. It is therefore generally accepted as a fact that the current must be taken from an overhead trolley. It then becomes a question as to how much current can be collected from an overhead conductor. At slow speeds 150 to 200 amperes can be collected for a few seconds. A current of 200 to 300 amperes may be collected continuously at high speeds, either by wheel or some form of roller or sliding shoe. The wheel can scarcely be considered, but both roller and sliding pantagraph trolleys have been used.

It is of the greatest importance to have the overhead construction very flexible and to have the current collectors light. Otherwise there will be flashing, and the trolley will become kinked at every suspension point so that it will soon break. It is also undesirable to increase the number of collectors. All of these things tend to limit the amount of current that can be collected for a single train, and consequently render an increase in voltage necessary.

Locomotives of over 3,000 horse-power capacity have been designed, and it will probably be necessary at times to operate two such locomotives in a single train. Even with one of them operating at rating, a current of about 750 amperes would have to be collected with a voltage of 3,500 volts direct current. Granting that two collectors might be used, the current per collector would still be close to, if not beyond, the range of anything that has been successfully accomplished up to the present time in high speed service. It is believed that 3,500 volts direct current is about the lowest voltage that should be considered for high speed trunk line service, on account of the difficulties of current collection. Lower voltages may, of course, be used for lighter and slower service. Whether locomotives can be made commercially with this high voltage, remains to be determined. Even if locomotives were built, however, it is very certain that such a voltage is entirely beyond the range for multiple unit-car operation, so that any line operating at 3,500 volts direct current would be confined to locomotive service.

The single-phase system is the only one that has successfully solved the problem of current collection at high speeds. The usual voltage for heavy railway work in this country is 11,000. In Europe it is even higher, 15,000 for the Loetschberg tunnel line, and this will probably also be used in Germany in the electrification of the State Railways. Either voltage makes it a comparatively simple matter to collect current for the heavy high speed trains.

The New York, New Haven & Hartford Railroad, which is using the 11,000 volt single-phase system, is steadily extending its electrification. It is practically the only company that is making such extensions. They have the Oak Point yards and the Harlem River division equipped now and are doing their switching with electric locomotives. They have suburban service on the New York, Westchester & Boston Railway, and they are rapidly extending the main line electrification to New Haven, so that in a very short time they will run from New York to New Haven with electric locomotives. At the same time, they are figuring on the line from Boston to Providence which will probably soon be electrified. Such extensions indicate that the system is satisfactory.

New Cars for O. E. R.

Some considerable extensions to the street car lines in Ottawa are proposed by the Ottawa Electric Railway. In the spring, work will be begun on the extension of the Bank street lines across the new bridge, spanning the Rideau Canal, to the city limits in Ottawa South, a distance of about a mile from the present terminus on Bank street. Twenty new cars are now being built by the Ottawa Car Company to be put on the Bank street lines when the new tracks are laid. These cars will be of the semi-convertible type with short platform and vestibule at the front end for control apparatus and a long platform at the rear end with railings, etc., arranged for the collection of fares by the p.a.y.e. system.

The general dimensions and carrying capacity of the cars are: length over bulkheads 33 ft. 3 in.; length over bunters 45 ft. 3 in.; length front vestibule 4 ft. 6 in.; length rear vestibule 6 ft. 6 in.; seating capacity 42 persons. The construction of the bodies will be what is known as the all-steel frame with the main side plates forming the outside sheeting. The interior finish will be in red cherry with the panelling in the doors, etc., outlined with inlay lines of ebony and white holly. The ceilings will be of three ply wood veneer and painted.

The seats will be of the non-reversible type, upholstered and covered with metal spring rollers and Forsythe coach curtain fixtures. All fittings such as door handles, window locks, handrailings, etc., will be of solid bronze and of the most modern design and finish.

The trucks will be Brill, Standard No. 27-FE-I, 4 ft 10 in. wheel base with Schoen rolled steel wheels. The motor equipments will be Westinghouse No. 101-B-2 four motors per car with one K-35 controller, one circuit breaker and Malloy trolley base. The air brakes will be Westinghouse schedule S-M-E, with D-2 motor driven compressor, type J compressor governor, 10 in. x 12 in. cylinder stock adjuster, reservoirs and other accessories.

Peter Smith forced ventilation and hot air heating system is to be used and C. C. H. Co's. buzzer signalling apparatus; Stanwood steel steps; vertical wheel hand brake and any other modern fittings and appliances that will tend to facilitate in the operation of the cars and add to the convenience and comfort of the passengers.

A 3200 kilowatt Westinghouse turbo-generator is now being installed by the Ottawa Electric Company in their power house on Montreal street, and will be in operation early in the spring. A Babcock and Wilcox boiler, marine type, will supply the steam for this generator. A building for the boiler has just been built, 90 x 40 feet.

A similar equipment is being put in for the Ottawa Electric Railway Company at their power house on Victoria Island. This will not be ready for use until the fall of 1913.

A New Feature Introduced

The floors of these cars are to be laid double thickness with heavy builders' tarred paper between. This is a distinctly new feature in street car building and one which promises to add greatly to the comfort of the passengers, both by making the car much warmer than the old style single floor and by acting as a muffler for the noise of the motors and running gear below.

Electrification of L. & P. S. Railway

The Hon. Adam Beck's attitude with reference to the electrification of the London and Port Stanley railway system has been considerably strengthened by a recent report of Mr. W. S. Murray, chief electrical engineer of the New York, New Haven and Hartford Railway system. Mr. Murray's report makes it plain that he believes that the expenditure necessary for the electrification of the L. and P. S. Railway would be justified. This is especially the case because of the cheap rate at which this railway system will be able to purchase its power, being .5 and .6 as compared with the average price of anywhere between 1 and 1½c per kw.h. Mr. Murray's report states that he has found from experience that a pound of coal burnt under the boilers of a central electric power station and the power transmitted in the form of electricity to the car motor will produce, under exactly the same conditions, approximately twice the tractive effort of a pound of coal burnt in the fire box of a steam locomotive. Considering the rate quoted above being so much cheaper than the average, the saving would be proportionately greater.

Mr. Murray further states that the flexibility and increased traffic capacity of electric over steam equipment offers at once a reduction in train miles due to the possibility of increasing train weights. In the operation of the New Haven road trains aggregating 1000 tons are operated by one locomotive, which, in the case under discussion, would mean that one train each way would probably be sufficient to attend to all freight transportation over this line for some time to come.

The Preservation of Ties

Mr. Robert Bruce of Alex Bruce & Co., Fort Frances, with head office Glasgow, Scotland, sailed for home on Jan. 4th after spending some time looking over the Canadian field and getting the Fort Frances plant operating. Before leaving Mr. Bruce stated that his company were at the present time turning out about 3500 preserved railway ties per day and that this number would be increased to 8000 by next spring. The process of preserving which Messrs. Bruce & Co. are using is a German process for which they own the sole rights in Canada. The mixture used contains zinc chloride and aluminum sulphate as its chief ingredients into which the ties are dipped. By this process it is claimed that the ties are made fireproof as well as waterproof and that they are quite odorless and colorless. At the present moment this company have sufficient orders on hand for railway ties to keep their Fort Frances plant busy for some time to come, but anticipating a larger demand they will erect plants at both Edmonton and Vancouver.

Miscellany

The report recently submitted by Superintendent McIntyre of the street railway department, Berlin, Ont., shows total revenue for the year, $45,858; total expenditures, $39,827; net balance, $6,031. This does not make allowance for depreciation. The light and power commissioners have later decided to set aside ten per cent. of the value of the machinery; five per cent. for rolling stock, and three per cent. for track, as a depreciation fund. This totals $5,120, leaving net profits for the year, $911. Waterloo gets twenty-five per cent. of this amount and Berlin seventy-five per cent. During the past year this road carried 982,750 passengers, an increase over the previous year of approximately 200,000. The operating expenses per car mile in 1912 were 22.4c as against 26.2c in 1911.

The B. C. E. R. Company are trying out a "Near-side" car. This car provides only one point of entrance and exit, namely, at the front, where both the conductor and motorman are situated on an unusually roomy platform. The same company has recently purchased a number of cars equipped with rear wire gates of the folding type. These cars are specially designed to prevent accidents. If these gates work satisfactorily, which they are reported to be doing at the present time, it is understood the company will install them quite widely on cars now in service.

The Niagara, St. Catharines and Toronto Railway Co. are planning for the erection of a new substation at St. Catharines of 1000 h.p. capacity and one at Niagara-on-the-Lake of 500 h.p. capacity. About 75 per cent. of the grading work is done between St. Catharines and Niagara-on-the-Lake. Poles are being erected and all work of track laying, etc., will be continued throughout the winter. It is anticipated that this line will be operating by June 15th.

The Ottawa Electric Railway Company have just completed equipping a new sub-station adjoining the car sheds on Albert street. A 650 kilowatt Westinghouse motor-generator set has just been installed. The company are contemplating putting in two more such sets in different parts of the city, at an early date.

The street cars were tried out for the first time on December 19th, but owing to a shortage of power, which will be supplied through a turbo-generator now being installed, a complete service is not expected before the middle of January.

The directors of the Windsor, Essex and Lake Shore Railway Company, A. Eastman, general manager, are reported to be considering the construction of an electric road to London.

The Toronto Railway Company are trying out electric signs on a few of their street cars.

Illumination

Ornamental Illumination

As indicating the progress of scientific and ornamental illumination at various points in Canada, the following recent contracts awarded to the Adams Bagnall Company for their pressed steel Luxolabra are of more than passing interest. For the most part this equipment is installed and all is delivered.

At the present time Galt is being supplied with about 200 Luxolabra standards, chiefly of the type known as No. 1—one light, shown in Fig. 2. These will be distributed as follows: Lansdowne avenue 26, Brant Road 52, Aberdeen street 12, Wentworth avenue 34, Crescent Road 12. All the number 1 type carrying a single 250 candle power tungsten lamp enclosed in a 16-in. globe. The town of Galt is also installing a number of five-light ornamental Luxolabra, including 12 on Dixon street and 20 on North Water street. Eighty-four of the single light type will also be run out Blair Road, a suburban residential district where these lamps will be placed about 200 feet apart. On West Main street, Galt will also use 20 of the type shown in Fig. 2 and a number of three-light ornamental units similar to the five-light units on Dixon street.

As indicating the high standard of illumination maintained in Galt, Fig. 6 represents a stairway leading up to the town park district. On each of the newel posts shown in this figure will be installed a pressed copper standard as shown in Fig. 5. These standards will be four feet six inches in height and will present a very beautiful effect.

The service wires for this work are placed underground, the current being carried by three wire, number 4 B & S,

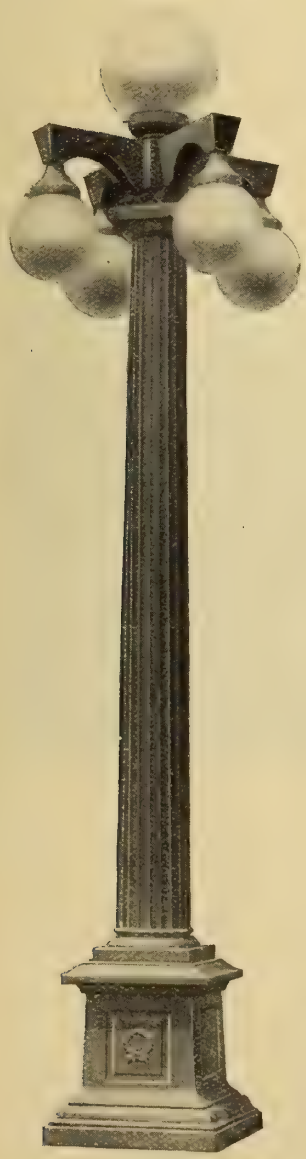


Fig. 1

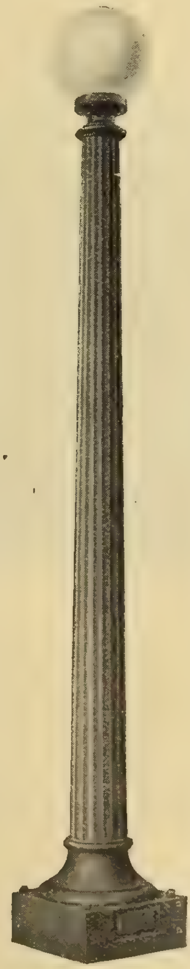


Fig. 2

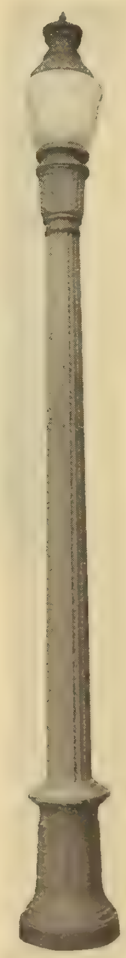


Fig. 3

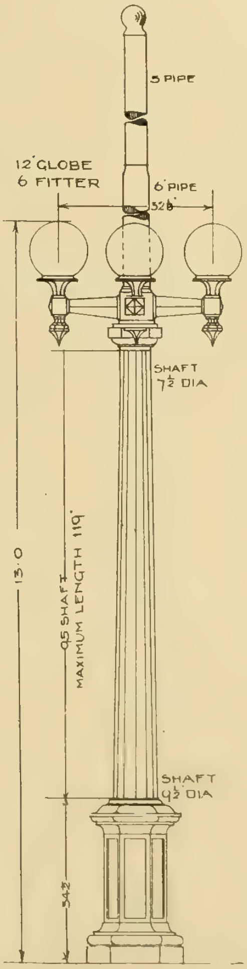


Fig. 4

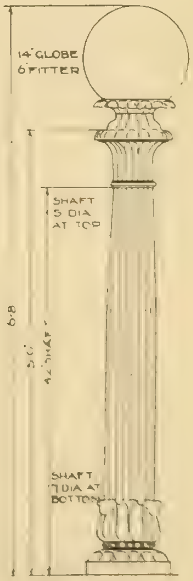


Fig. 5

standard cables, leaden cased, paper insulated. This wire is being supplied by the W. T. Henley Telegraph Works Co.

Berlin is also installing some fifty odd poles of the type shown in Fig. 2, each carrying 250 candle power tungsten lamps. The distribution system in Berlin is all underground and equipped with 5 x 6 x 6 cement manholes with room for four 10 kw. transformers. At the present time one 15 kw. Maloney subway transformer is installed in each. From the manholes conduits have been run to each individual factory.

Fig. 6

Further installations include one in St. Catharines by the Lincoln Light, Heat & Power Company. This installation includes 36 five-light standards of the type shown in Fig. 1. Waterloo is installing eight units similar to Fig. 1, but carrying three lights. Dunnville has installed four five-light standards of somewhat more elaborate type.

Fig. 4 further illustrates a type of ornamental combination standard being tried out in both Galt and Berlin, the idea being that these two towns will, if the equipment proves satisfactory, be connected along the railway line connecting these towns by similar equipment. This unit is a combination ornamental light standard and trolley pole, which, however, are quite separate from one another. Vibrations from the trolley pole will not affect the lamps inasmuch as a washer cushion is installed between the pole and the hollow standard at the upper end of the latter. The joint at this point is also waterproof.

The City of Winnipeg is installing 100 Union metal pressed steel standards surmounted by G. E. magnetite arcs, Fig. 3. These standards are from 14 to 16 feet in height, have a burning life of approximately 100 hours, light capacity of approximately 1,600 candle power and are placed one hundred feet apart.

Calgary Arc Lights are Good

A Torontonian, prominent in electrical engineering circles, now touring the western provinces, writes from Calgary,—

"All the public utilities in Calgary are publicly owned—electric light and power, street lighting, street cars and telephones. The street lighting is splendid, particularly on the main business street, 8th avenue, where they have magnetite arcs, with opal globes, 110 feet apart on both sides of the street supported on the trolley poles. They consume no more current per lineal foot of street than the popular five light tungsten clusters, and give a very much better light. In many of the residential streets, magnetites, with clear globes, from 300 to 600 feet apart are used, and give good results. Of course there are no trees of any size in the streets to throw shadows."

Stratford, Ont.

The report for the eleven months ending November 30, 1912, recently issued by the Light and Heat Commission of Stratford, Ont., showed such a considerable surplus over all expenses that the Commission feel themselves justified in estimating the yearly surplus at $4,000. The report gives the total number of customers as 1,017, divided into 627 domestic, 314 commercial and 76 power. When the business was taken over from the private company in July, 1910, the total number of customers was 318. The commission is composed of Messrs. J. J. Mason, chairman, Angus McDonald and Mayor Brown.

High Tension Insulators

Mr. P. W. Sothman, formerly chief engineer of the Hydro-electric Power Commission of Ontario, and now head of the consulting engineering firm of P. W. Sothman & Co., Toronto and New York, recently presented a paper before the American Institute of Electrical Engineers on the subject of high tension insulators. Mr. Sothman's paper reviewed intimately the work done in connection with the selection of insulators for the Commission's 110,000 volt transmission line in southwestern Ontario.

Victoria, B.C.

The value of an auxiliary steam plant was demonstrated recently when the Jordan River hydro-electric plant of the B. C. E. R. Company was disabled during a heavy electric storm. This company has just recently completed a steam turbine plant, capable of developing six thousand horse power, which was in operation a few minutes after the damage to the hydro-electric units was reported. The accompanying cut illustrates the conditions under which power companies operate successfully in British Columbia. The photograph was taken at the Jordan River power plant.

Lightning flash taken at Jordan River power plant

The by-laws submitted to the ratepayers of Ottawa on Monday, January 6th, asking for permission for the Morrisburg and Ottawa Electric Railway to enter the city and also to allow the Ottawa Electric Railway to make some extensions in the suburbs were carried by big majorities.

The Dealer and Contractor

Contractors' Publicity and Advertising

The following extracts from an address recently delivered before the 12th annual convention of the National Electrical Contractors' Association, bear especially on the value of advertising to the electrical contractor,—

Advertising may not be quite everything in business, but everything in business is advertising. We are advertised by all that we do. In a successful business, needless to say, the advertising is constructive even though there may be exceptions to prove the rule, and a business may prosper for a time in spite of poor advertising.

There are just two classes of electrical contractors,—the satisfied and the ambitious. To the first class this subject has no appeal; they have enough business, so why advertise? Why reach out for business To the second class I hope to relate a few experiences, and to give a little data which will be profitable. Advertising anticipates sales, whether sales of wire, of conduit, of labor, of brains or what not, for the whole aim and object of advertising is the increase of sales.

I have purposely inserted the word "publicity" in my subject because there is a vital distinction between publicity and advertising. Publicity plus salesmanship equals advertising. Publicity alone does not make sales. It lacks that element of vitality which points to the dotted line with the assuring confidence necessary to induce the customer to sign a contract or to order with a smile of satisfaction. Add your personality, your integrity and your sales instinct to your publicity effort, and the result is advertising, such as is now supporting twenty-three thousand newspapers, 34,000 magazines, and thousands of print shops doing an aggregate business of $137,000,000 per annum in advertising. Advertising expenditure of the country does not prove that all successful business houses are advertising, and advertising successfully—I am not so fanatical as to claim that—but it surely does indicate that the majority of successful business houses are advertising and that some of them are doing it pretty heavily. The fact that the publishing business has grown 25 per cent. during the past ten years, is proof that greater number of advertisers are spending greater appropriations and that in the majority of cases the results are such as to encourage further advertising. There is no doubt but that proper advertising does increase net profits, and that the subject must be considered by every business man who looks for commercial growth.

I believe that conditions have changed very materially in the past year, and that almost every city has to-day, at least one electric shop that conforms to modern merchandising standards. The business-like clerks and demonstrators are more in evidence this year, and electric merchandising has grown from a mere interrogation point to a recognizedly successful business occupation. With this development, namely merchandising, which is really a great stride toward making the electrical contracting business more profitable, has come a more liberal use of advertising. Every merchant appreciates the use of advertising methods as a means of inducing prospective customers to enter his shop. The two developments, merchandising and advertising, are inter-dependent. If either is to be effective it must be supported by the other.

The writer is most familiar with the results obtained in Cleveland, so you will grant him plenary indulgence if he talks of his home city. In Cleveland 16 electrical contractors have been advertising during the past year. The largest expenditure for advertising space by any one contractor, has been $1,000, or about 3½ per cent. of sales. To this expenditure he attributes the securing of at least 20 per cent. of 212 house wiring contracts secured during a recent sixty day whirlwind campaign. The average house wiring contract was for $40, and allowed for a profit of $8 or 20 per cent. The profit on the increased business in house wiring alone, would, on the above basis, net this one contractor over $331 in profits, while the increase in store sales, contracts pending but not signed, etc., swell the total so as to over-balance easily, the $1,000 expended in advertising. However, advertising should not be figured on any basis whereby you expect to receive $1 to-morrow for 87 cents invested to-day. The cumulative effect of consistent advertising is of greater value than any immediate direct returns. Just as the good will of a reputable established firm is often of more value than its tangible assets, so is the cumulative effect of advertising of greater value than the immediate returns. I have yet to learn of a single Cleveland contractor who has joined the advertising movement, who has not received his money's worth. Most of them have used the newspapers,—not by taking large space, but by using small cards, which are quickly and easily read, and which keep the name and the service before the people. In three Cleveland newspapers a co-operative newspaper electrical advertising page, called the "People's Electrical Page," is maintained throughout the fall, winter and spring by the mutual efforts of the 16 contractors above mentioned, together with several manufacturers, the central station, and the telephone company.

Advertising Mediums

In addition to the newspapers, the telephone directory has been an effective medium of contractor advertising. In one case space was taken on ten pages, which gave good representation on all pages listing electrical manufacturers electrical engineers, illumination companies, and electrical jobbers. The cost of this representation was $33 and the advertiser places many telephone inquiries to this 'phone directory advertising.

The city bill boards and the flashing electric sign over the contractor's place of business have also contributed to the success of the general advertising by Cleveland contractors.

The use of the mail, especially for the distribution of high potential sales letters, has proven mighty fruitful. I am somewhat of an optimist in regard to most advertising, but especially in regard to the use of personal letters. One Cleveland contractor has been following the plan of dividing the city into sections and canvassing one section at a time, to obtain complete data as to the possibility of wiring old houses. All prospects have been carefully listed, and letters have been mailed to every prospect. In each letter was enclosed a stamped return postal card. About 20 per cent. of these cards were returned, indicating the desire of the prospect to learn more about the cost of electric wiring. As the next step, these inquiries were followed up with personal calls, and good salesmanship brought back many orders which netted a profit.

There is little chance of a contractor becoming known to those needing his services unless he talks to more people than those reached by him personally, and there is no chance of landing contracts or orders unless he is known. One might meet personally, twenty persons a day, but through advertising he can become known to thousands in a short time. As Elbert Hubbard puts it, "One must make his money out of his friends: his enemies won't deal with him." Our friends are those who know us, and know our methods and ability; by modern advertising you can make friends with all prospects for the service you may offer. A man can't buy himself a character, and neither can the electrical contractor, but having the character and the ability to deliver the goods, he can buy himself a reputation,—by advertising.

The manufacturers, in particular the lamp manufacturers, are offering more extensive advertising assistance to contractors this year than ever before. The stand that so many contractors have taken regarding electrical merchandising, has given the manufacturers renewed confidence in the ability of the contractor to become an economical distributor of lamps, and they are, therefore, planning to assist him further in his advertising and sales. General publicity in the big popular periodicals will be a feature of this cooperation. The vast sums of money that will be spent in these mediums should be taken advantage of by every contractor.

Follow up Your Advertising

Follow your advertising closely, and show conspicuously that you have the goods for sale. Do this by means of the local papers, the street cars, the moving picture shows, and without fail, your own display windows. Take advantage of the aids that the manufacturers will offer you. Use the manufacturer's advertising services, ask him to formulate suggestions, and use them where you can. You may sell carloads of electrical goods, but the manufacturer has gleaned ideas from merchants in other places, and from contractors with other electrical merchant contractors with whom he deals. In any of your publicity it is well to ask the manufacturer for his co-operation. It is part of the service that helps at your disposal.

Perhaps the key-note of the assistance offered by the manufacturers in the sale of lamps, will be the travelling window displays which may be used by the contractor, as a feature window attraction. A large number of these features will be provided. They will be special attractions usually displaying lamps or electric light by motion and color. There will also be displays such as miniature houses, completely equipped electrically with moving puppets operating electric lights. Aside from these features, there will be special paper trims for the windows. By the use of the display window, any contractor may connect with the larger advertising campaign of the manufacturer.

The remarks that I have made might be summed up briefly in the form of a few suggestions.

Advertise, but have a plan back of the advertising.

(1) Use newspaper space, but use it discreetly. Take small space often, and keep your name and service before the people. Remember that a three-inch real estate advertisement is often more convincing that a whole page of automobile copy. Co-operative newspaper advertising is most effective, and this is a practical matter that can well be brought before local electrical organizations such as Electrical Clubs, and Leagues, Luncheon Clubs, Jovian Clubs, etc.

(2) Your copy—the value of your ad. depends upon what you say, and how, and not on how much. "Know what you want to say, say it and stop," is the advice of a prominent advertising expert. Let the prospect get your story at a glance.

(3) Your windows—don't let them get the loafing habit. Your window is one-half to three-quarters of your store's publicity value. Don't waste it for a single hour, but keep it working. A professional departmental store trimmer's time may be had for a few dollars. Use motion—a bug creeping on a carpet attracts immediate attention. Apply the principle of motion to your window trim.

New Branch Offices

The Standard Underground Cable Company of Canada, Limited, have established new branch offices at Montreal, Quebec and Winnipeg, Manitoba, in order to facilitate the prompt handling of their growing business. The Montreal office will handle all business from the province of Quebec and the eastern part of the province of Ontario. This office is in charge of Mr. R. G. Harris, formerly connected with the general offices of the Standard Underground Cable Co., Pittsburgh, Pa., but more recently with the New York sales office of that company. The Winnipeg office will handle all business coming from the provinces of Alberta, Saskatchewan, Manitoba and that portion of the province of Ontario lying west of Ft. William. Mr. B. S. Stewart has charge of this office. Mr. Stewart has spent some time in the general offices of the associate American company, Pittsburgh, Pa., later going to the Chicago sales office of that company where he has spent a number of years. Business originating in the province of British Columbia and in Alaska and Yukon Territories will be handled by the Seattle, Wash., office of the company, and business from the Maritime Provinces will be handled by the Boston, Mass., office. This is a temporary arrangement in order to secure prompt service for customers in those districts until the volume of business justifies establishing separate offices in the Dominion.

The general offices of the company at Hamilton, Ont., will handle all business from the central and northern portions of the province of Ontario. Mr. W. H. Marsh, sales manager and secretary of the company, has direct charge of business coming into this office as well as general supervision of the various branch offices. The establishment of these branch sales offices puts the Standard Underground Cable Co., of Canada, Ltd., in an excellent position to handle with accuracy and despatch all business which they may secure. The men in charge of the various offices are salesmen of experience and ability, released by the associate U. S. company in order to strengthen the personnel of the Canadian company.

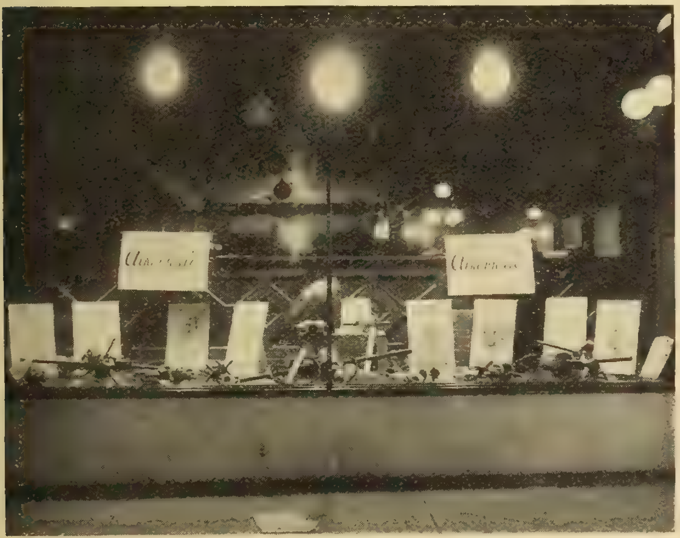
Condulets

We reproduce below the specifications followed in the galvanizing of the Crouse-Hinds condulets. The requirements and tests appear to be sufficiently severe to guarantee the customer against anything but thoroughly reliable material.

The fittings shall be thoroughly cleaned, pickled, and then electro-plated with a coating of zinc. This coating must adhere firmly without scaling or blistering, to every part of the casting. Any specimen must be capable of withstanding the following test:—a sample shall be immersed in a standard solution of copper sulphate for one minute, and then removed and immediately given a thorough washing in water and wiped dry. This process shall then be repeated. If, after the fourth immersion, there should be a copper colored deposit on the sample or the zinc should have been removed, the lot from which the sample was taken shall be rejected. The standard solution of copper sulphate crystals has a specific gravity of 1.185 at 70° F. and during the test the temperature of the solution shall not be less than 60° F. nor more than 70° F. (Note:—The above test shall be taken as applying to the outside surfaces of the castings only. Any such copper deposits forming on the inside surfaces shall not be taken as evidences of failure to comply with the specifications). To prevent corrosion and insure a smooth interior surface, all fittings shall be thoroughly cleaned and pickled on the inside and finished with a heavy coat of insulating enamel.

Motor-operated Drills

A piece of apparatus which is winning its way very quickly into all kinds of factories, work shops, etc., is the motor-operated electric drill. One of the most satisfactory types is that manufactured by the Van Dorn & Dutton Company, the Canadian agency for which is held by Mr. A. Ross Oborne. The popularity of this particular type of drill is shown by the fact that between 400 and 500 of them have been sold in Canada during the past year, the purchasers including the names of most of the wood and metal working factories, bridge works, railway shops, piano works, and electrical contractors. The electrical contractor has found this apparatus a very valuable adjunct in placing his wires where walls or floors or beams or any other obstruction has to be pierced. In this case the ordinary auger attached to the electric drive does the work quickly and neatly. During the last few days an order has been received from the Office Specialty Company requiring the supply of one drill to each of the ten branches of this company. Much of the success of this particular drill is due to the fact that it is made to stand hard service and that it is equipped with what is known as the "universal" motor, which means that it will operate on either direct or alternating current. The cut shown illustrates a demonstration of this apparatus recently made by the Aikenhead Hardware Company, Limited, in the display windows of the Toronto Hydro-electric System.



1913 Diaries

The Canadian Westinghouse Company, Limited, of Hamilton, Ont., have distributed their very useful diary, as is their usual custom with the New Year. This diary contains a very great amount of condensed and valuable information which the average engineer will find it worth while carrying around in his pocket. The cover design and the binding are even more attractive this year than usual.

The Siemens Company of Canada, Limited, are distributing a very handsome pocket diary for the year 1913 which also includes an insurance coupon. The diary is supplied with a neat pencil pocket and pencil and a handy marker on which the words "Siemens Brothers Dynamo Works" appear in gold.

New J.-M. Plant

The H. W. Johns-Manville Company have just completed their new plant at Manville, N.J. The new plant consists of nine buildings, which, together with their products, are classified as follows: A.—Textile and Packing. B.—Rubber Plant; Electrical Specialties and Printing Department. C.—Pipe Covering. D.—Paper Mill. E.—Magnesia. F.—Roofing. G.—Mastic and Waterproofing. H.—Roofing Coatings. I.—Power Plant and Pump House.

These buildings represent the most advanced ideas in fireproof construction, being of brick, steel and concrete, with roofs of J-M asbestos roofing. They are planned not only for safety but to afford the best operating conditions for the employees. The "daylight" form of construction which is empolyed throughout permits a flood of light to enter the buildings through large triple-unit windows placed close together. The walls, ceilings and uprights are coated with J-M fireproof cold water paint. Artificial illumination is provided in the form of J-M linolite lamps and Frink reflectors.

"Northern Light" Tungsten Lamps

The Northern Electric and Manufacturing Company, Limited, have recently introduced on the Canadian market a complete line of high efficiency incandescent lamps under the name of "Northern Light." These lamps are manufactured under Canadian patents and are made up on a very rigid specification. All possible means is taken to insure every lamp being of rated capacity, high efficiency and long life. The "Northern Light" lamps are made in all styles of standards and in continuous wire-drawn Mazda filaments, carbon filaments, and metallized carbon filaments. The company have issued an attractive price list covering these "Northern Light" lamps.

The McGill Catalogue

The McGill Manufacturing Company of Valparaiso, Ind., manufacturers of lamp guards, portables and other electric specialties, have issued a very handsome catalogue for 1913, covering their complete line. Included in the products of this company are the well-known Loxon lamp guards, the McGill protector and portable guards, star soldering paste, baby gasoline torch, crescent coloring fluid, adaptable lamp changer, automobile trouble finders, etc. Among articles listed for the first time are the Gripson lamp guard which is an electrically welded guard made with reflecting top and furnished with two styles of cone shaped shades; also two new portables, the Imperial and the Jumbo, a vapor-proof water-tight portable for use in damp places. This catalogue will be of interest to every electrical jobber, dealer and contractor.

Change of Address

The Toronto office of the R. E. T. Pringle Co. are moving from their present quarters in the Continental Life Bldg. to 308-9-10 Tyrrell Building, King street east. The new quarters will be occupied about the 1st of February. This branch will be in charge of Mr. A. Ross Oborne as formerly.

Industrial ABolites

The accompanying sketch shows the new steel ABolite recently brought out by the Adams Bagnall Electric Company of Cleveland. It is known as the diagonal ABolite and is made in two general types, one for deflecting the light at an angle of 30 degrees, the other for a 45 degree deflection. This type is made in capacities from 25 to 500 watts varying in size from 7 in. to 16 in.

New Factory for Independent Electric

The Independent Electric Manufacturing Company, Milwaukee, Wisconsin, have completed a new factory and moved all their equipment and stock into the new quarters. The building is located on the south side of Milwaukee and is a most complete and up-to-date factory for the manufacture of starting and controlling devices. Before building the company spent considerable time in thoroughly investigating different modern manufacturing plants and have endeavored to build a shop combining many new features. The building is constructed of concrete and brick, both sides being fitted with a large number of steel frame windows giving ample light throughout the entire floor space. Special attention has been paid to the experimental and test rooms, the test room being equipped with motor-generator sets so that many variations of d.c. voltage may be obtained for testing d.c. apparatus. Transformers have been installed for the different alternating current voltages. Easements have been obtained from the railroad company for siding across the property and a switch track will be constructed to the shipping room door this coming spring. The property on which the factory is built is located on the Kinnickinnic river, making it possible to ship and receive by water as well as rail when necessary.

Kellogg Magnet Wire

The Kellogg Switchboard & Supply Company have just issued a series of novel advertising matter which includes also a quantity of valuable technical information. This company have made novel use of the fact that magnet wire is wound on spools and have printed their information in the form of twelve "Spools of Facts." These spools are printed on heavy stock in three colors to indicate the yellow wooden spool ends, glossy black of the enamel insulation and the green of the silk colored wire. Each spool is therefore an exact reproduction. In addition the Kellogg Company are distributing an attractive folder which describes the method of manufacture of good wire and calls attention to some of the finer points in its service which are not evident to the ordinary observer.

"Suggestions" for 1913

We are in receipt of the annual copy of "Suggestions" compiled by Mr. H. D. Bayne, special agent of the Canadian General Electric Co. Mr. Bayne has been particularly happy in his choice of eleven pithy resolutions. These are evidently for the last eleven months of the year, Mr. Bayne no doubt considering it unnecessary to add any more resolutions to the usual number we all make for January.

The Boston Office of The Cutler-Hammer Mfg. Co. moved from 176 Federal street to larger quarters in the new Columbian Life Building, the first of the new year.

Trade Publications

Binding Posts and Connectors—Bulletin No. 65, issued by the Kellogg Switchboard and Supply Company of Chicago, describing binding posts and connectors manufactured by this company.

High tension switches—Bulletin No. 100 issued by the Electrical Engineer's Equipment Co. of Chicago. This is an illustrated catalogue dealing with the various types of pole-top switches manufactured by this company.

Advertise—A booklet issued by the Kellogg Switchboard and Supply Company outlining the value of persistent advertising. This company has taken for its watch word "Advertise your Service and watch your lines grow."

Books for home study—The Norman W. Henley Publishing Co. have issued a catalogue of practical, scientific and technical works, each of which they claim is written by an expert and yet uses such simple language that the subject matter is easily understood.

C. G. E. Equipment.—The Canadian General Electric Co. have issued pamphlet No. 506 on "Ozonators," an equipment designed to improve the hygienic conditions wherever indoor air is breathed; power consumption approximately 70 watts. The same company have issued a small sheet describing "Hubbell Receptacles" and another describing "Hubbell Shade Holders."

Ornamental Lighting.—Catalogue issued by the Electric Railway Equipment Company, Cincinnati, illustrating and describing 1, 3 and 5-light ornamental lamp standards; combination railway and lighting poles; lighting fixtures arranged for Mazda lamps; brackets for supporting ornamental luminous arc lamps, etc. This is a very attractive catalogue, the illustrations covering the field very fully.

Westinghouse—The Westinghouse Electric & Manufacturing Company have just issued leaflet No. 3511 describing and illustrating box-frame commutating pole railway motors Nos. 317, 317-A, and 317 A-2. These motors are adapted for high speed interurban service and the A2 type is for use with field control; also folder 4245 describing the mechanism in detail and illustrating the working parts of the Universal blow torch; also a little folder entitled "Saving the Tires without Fire," which folder describes the automatic tire vulcanizer manufactured by this company.

Pneumatic Tools.—The Chicago Pneumatic Tool Company have issued a number of bulletins describing the Duntley electric and portable tools, a complete line of which they manufacture. These publications include bulletin E.22, describing heavy duty electric drills for alternating current; bulletin E.26, describing universal electric drills operating on direct or alternating current; bulletin E.27, describing heavy duty electric drills for direct current. The same company have also issued bulletin No. 34G, describing their air receivers, aftercoolers, air line drain traps, reheaters and economizers.

Current News and Notes

Bothwell, Ont.

The Florence Power, Light and Milling Company, Limited, has been incorporated with a capital of $5,000 for the purpose of developing, producing, generating and transmitting electric power with head office at Florence.

Calgary, Alta.

The contract of the Calgary Power Company with the city of Calgary has expired. The rate was $30 per year per horse power. Pending a renewal of the contract the old rate is being continued.

Contract has been awarded to the Ottawa Car Co. for 12 41-ft. 6 in. car bodies; 12 46-ft. 6 in. car bodies, and 6 44-ft. 6 in. trailers; also for 30 set Brill, 22 G1 trucks; also to Canadian Westinghouse Co. for 24 complete quadruple motor equipments, 24 complete air-brake equipments.

The citizens passed a by-law authorizing the street railway extensions. A vote was also taken on a by-law to grant certain rights to the Alberta Interurban Railway Company. This was defeated, however, on the ground that the agreement was not sufficiently explicit in its terms, and allowed the company, among other things, the privilege of operating its lines through central streets of the city by steam, if it desired to do so.

Cambie, B.C.

The Richmond council has unanimously decided to take over the Farmers' Telephone system.

Fort William, Ont.

$40,000 was voted for the extension of the municipally owned street railway system.

Guelph, Ont.

The rates of both light and gas have been placed on a different basis with the New Year. Gas has been reduced 5c per thousand cubic feet, and now stands at 75c, 80c and 85c, depending on the quantity used. Instead of a straight 8c rate for lighting, the floor area method is being inaugurated which in some cases will also mean a reduction.

Galt, Ont.

The 1912 report of the Hydro-electric Department of the municipality of Galt states that the manner in which the power load is increasing is perhaps the most gratifying feature of the whole system as a big power load is the best guarantee of cheaper rates. Starting with a connected load of 25 h.p. this has been increased to a connected load of 750 h.p. with prospects of immediate further increases. This does not take into account the Waterworks Department or the Grand Valley Railway.

Humboldt, Sask.

Contract for engines and boilers let to E. Leonard & Sons, and for electric equipment let to C. G. E. Chipman & Power engineers.

Hamilton, Ont.

Barton Township has made application to the city for an extension of the hydro-electric system to this section.

London, Ont.

The people did not vote on the Sunday car by-law.

It is likely a by-law will be prepared asking citizens to expend $1,000,000 on electrifying the London & Port Stanley Railway.

The gross earnings for the year 1912 of the London Street Railway Company are said to show an increase of ten per cent. over 1911.

The composition of the new city council indicates that Mr. Beck's scheme for the electrification of the London and Lake Erie Railway can be carried through.

Lansing, Ont.

It is reported the Toronto and York Radial Railway Co. will build a spur line connecting this place with Markham.

New Glasgow, N.S.

It is reported the electric line is being extended next year into the southern part of the town.

New Westminster, B.C.

The B. C. Electric Ry. Co. have submitted plans to city council for approval, of railway yards to cost $200,000.

It is reported that the city council has entered into a new contract with the B. C. E. R. Co. for eleven years for the supply of power at 1¼c per kw. hour. The former rate was 1.46c.

New Waterford, N.S.

The Dominion Coal Co., Glace Bay, are asking estimates for equipment for colliery plant of capacity of 20.000 kilowatts.

Ottawa, Ont.

By-law passed authorizing the Morrisburg and Ottawa Electric Railway Company to construct its railway, and to operate the same by electricity or by gas and electricity, within the city of Ottawa to a terminal point named in the by-law.

Parry Sound, Ont.

Ratepayers passed by-law Jan. 6th to extend electric lighting system.

Prince Albert, Sask.

Tenders will soon be called for hydro-electric penstock, canal excavations, tail-race excavations and concrete work; plant to develop 15,000 h.p. at La Colle Falls. C. H. & P. H. Mitchell, engineers.

Richmond Hill, Ont.

The electric light supplied by the Toronto & York Radial Railway Company was turned on along the main street for the first time on December 30th. It is reported that very satisfactory comments were made on the result of the new installation.

The by-law ratifying the agreement with the Toronto and York Radial Railway Co. for the supply of power to this town, carried by a very large majority.

St. Marys, Ont.

The superintendent has been instructed to prepare estimates for extending power lines, also to get figures on recording instruments for keeping a check on the peak load.

Sarnia, Ont.

Tenders will be called shortly for a large number of additional electric lights.

Sydney, N.S.

Maritime Telegraph & Telephone Co., Ltd., head office Halifax, N.S., contemplate installing switchboard in North Sydney & Sydney Mines Exchanges in the spring.

The Maritime Telegraph & Telephone Co., Ltd., contemplate improving whole system east of Halifax, also making several extensions.

St. Thomas, Ont.

The London and Port Stanley Electric Railway is now being operated entirely by power supplied by the Hydro-electric Power Commission of Ontario.

Stratford, Ont.

The by-law granting a 25-year franchise to the Sir William MacKenzie interests was carried by a large majority.

St. John, N.B.

The number of telephones in use in this city is now 5,000, an increase of 700 during the last year.

Saskatoon, Sask.

By-laws totalling three-quarters of a million are being submitted to the electors early in the year. This includes an expenditure of $175,000 on electric light extensions.

The question is again being considered whether the city shall return to its original custom of conducting a department for the sale of electrical supplies.

Toronto, Ont.

Every hydro-electric by-law submitted in Ontario was carried by a very large majority. The by-laws, which were either to authorize the expenditure of certain sums of money or to enable the council to negotiate with the Commission, included the following places: Goderich, Clinton, Sarnia, Peterboro, North Bay, Uxbridge, Stouffville, Markham, Cannington, Beaverton, Winchester, Rockwood, Stayner, Exeter, Elmira.

The civic car lines on Gerrard street will be operated on Sunday.

Preliminary reports made public by the Hydro-electric Power Commission indicate that the cost to date of the distribution system for serving the municipalities is $4,158,829, That is made up as follows:

Right of way		$ 542,088.85
Transmission lines—		
Steel tower lines	$1,537,977.72	
Wood pole lines	493,037.99	
Telephone lines	129,668.95	
Relay system	54,537.32	
Conduit and cable system	40,907.88	
		$2,256,129.86
Transformer stations		1,322,806.73
Distributing stations		57,803.80
Total		$4,158,829.24

Vernon, B.C.

The Elec. Ltg. Commission have recommended purchase of supplies for light extensions.

Winnipeg, Man.

Chapman & Walker, 305 McGreevy Blk., have been awarded contract for transformer equipment for 17 pump houses.

Condensed Department

RATE

Positions Wanted
Positions Vacant
Miscellaneous.
} 2 cents a word per insertion.

Tender advertisements, equipment for sale, etc., 15 cents per agate line (14 agate lines make one inch) per insertion.

Advertisers who wish to conceal their identity may do so by using an Electrical News box number without extra charge.

Forms close on the 18th of each month.

CITY OF MOOSE JAW
SASKATCHEWAN

Tenders for Electrical Machinery

Sealed tenders marked "Tenders for turbo-generator" will be received by the City Commissioners, Moose Jaw, Sask., up to 12 o'clock noon on **Monday, February 10th, 1913**, for the manufacture, supply, delivery and erection of one 1,500 kw. steam turbine and generator.

Specifications and general conditions may be obtained upon application to J. D. Peters, Electrical Superintendent, Moose Jaw; The Commercial Intelligence Branch, Board of Trade, 73 Basinhall street or London Chamber of Commerce, London, England.

The lowest or any tender not necessarily accepted.

A. W. MAYBERY,
L. W. RUNDLETT, Commissioners.
W. F. HEAL,

2

Situations Vacant

Draughtsman — First-class, experienced in Switch Gear for High Tension and Low Tension A.C. work for large Hydro-Electric Plant in Canada. Must be neat, accurate, capable and able to do designing and layout work under supervision. Also Junior on similar work. Apply to Toronto Power Company, Niagara Falls, Ont., Canada. 1-2

WANTED — Electrical travelling salesman, technical graduate preferred. Good opening for man who is efficient and who has ability. Write, giving age, experience, etc., to Box 680, Electrical News, Toronto, Ont. 2-2

Draughtsman wanted, by Toronto Hydro-electric System, experienced on High and Low Tension, Sub-station Design. Good salary. Apply Station Department, 228 Yonge Street, Toronto. F

Situations Wanted

Electrical Engineer, McGill graduate, seven years' experience with steam, hydraulic and internal combustion generating plants, operation and construction, wishes position as superintendent of power system or with consulting firm. Will go anywhere but prefer British Columbia. Salary $2,000 per annum. Reply Box 666, Electrical News, Toronto, Ont. 1-3

Position wanted by Electrician as operator in power house or would like to manage same. Familiar with A.C. and D.C. currents. Age 22. Single. Western town preferred. Box 677, Electrical News, Toronto, Ont. 2

Electrical Superintendent or Foreman

Man of executive ability and technical training, would like a change to position with good prospects. Thirteen years' experience in construction and maintenance. Best references. Box 421, Electrical News, Montreal. 1

Position as Hydro-electric Power House Superintendent of small plant or assistant in larger plant. Ten years practical experience in care, maintenance and operation of power house and sub-station apparatus. Good technical education. Associate A. I. E. E. Best references. Box 659, Electrical News, Toronto, Ont.

Electrician open for engagement—experience in wiring, operating and repair work. Best references; age 26. Apply Box 670, Electrical News, Toronto, Ont. F

Patent Act

Take notice that the undersigned are prepared to supply at a reasonable price the furnace for steam boilers described in Canadian Patent No. 109,928, January 28th, 1908, or to grant anyone a license to have the same manufactured for him at a manufacturing establishment in the Dominion of Canada. They are also prepared to receive offers for the purchase of the patent or for licenses to manufacture under the same. Ridout & Maybee, 59 Yonge Street, Toronto, attorneys for Henry Schofield. 1

Car Ventilating Systems

The Vacuum Car Ventilating Company has commenced manufacturing Mechanical Car Ventilating Systems under Canadian Patent No. 128070, dated September 13, 1910, and is prepared to furnish same on demand. For detailed information and prices, address Lock Box No. 25, Windsor, Ont. 10-t.f.

Notice

The undersigned, attorneys for the patentee, are prepared to grant licenses, at a reasonable price, to all desiring to use the method of producing electric oscillations described in Canadian letters patent No. 119,908, issued on the 10th day of August, 1909, to R. C. Galletti. Ridout & Maybee, 59 Yonge Street Toronto. 1

CITY OF REGINA, SASK.
REGINA MUNICIPAL RAILWAY.
TENDERS
FOR
TRACK and TROLLEY MATERIAL

Sealed tenders registered, and clearly marked on the outside of the envelope "Tenders for the Supply of Street Railway Materials," and addressed to the City Commissioners, Regina, Sask. Canada, will be received up to noon **Monday, the 24th day of February, 1913**, for the supply of:—

CONTRACT D.

1100 long tons street railway steel 7-in. Tee rails, Lorain section 80/335.
1550 pairs 6-hole 26-in. splice bars for Lorain rail section 80/335.
1040 long tons street railway Tee rails, 60 lb. A.S.C.E. section.
2000 pairs 4-hole 24-in. angle bars for 60 lb. A.S.C.E. steel rails.
10000 track bolts and nuts, 3½-in. x 1-in., oval heads, hexagon nuts.
9000 track bolts and nuts, 3¾-in. x ¾-in., oval heads, hexagon nuts.
10000 split lock nut washers for 1-in. track bolts.
10000 split lock nut washers for ¾-in. track bolts.
660 kegs (each keg 200 lbs.) standard railroad spikes, 5½-in. x 9/16-in.

CONTRACT E.

5400 4/0 standard copper rail bonds, 10 ⅛-in. C.C.
3600 4/0 standard copper rail bonds, 13-in. C.C.
630 4/0 solid copper rail bonds, 62-in. C.C.
60 4/0 solid copper rail bonds, 72-in. C.C.

CONTRACT F.

10000 standard sawn square B.C. fir railroad ties, 6-in. x 8-in. x 7 ft.
35000 standard sawn square B.C. fir railroad ties 6-in. x 8-in. x 8 ft.
1250 Western cedar poles, 30 ft. long, 7-in. top.

CONTRACT G.

20000 barrels Portland Cement.

CONTRACT H.

21 miles 2/0 hard drawn trolley wire.
12 miles 4/0 D.B.W.P. 19 stranded copper wire.
4 miles 2/0 D.B.W.P. 7 stranded copper wire.
10 miles 3/8-in. stranded soft drawn iron wire.

CONTRACT J.

Insulators, Hangers, Brackets, Pullovers, Turnbuckles, Trolley Frogs, Crossovers, Clinch Ears, Pole Line Hardware, etc., etc.
All material to be delivered F.O.B. Regina, Freight and duty PAID.

Copies of specifications, schedules, delivery dates, and form of contract, and other particulars can be had upon application to H. Doughty, Superintendent, the Regina Municipal Railway, Regina, Sask., Canada.

Persons tendering are notified that tenders will not be considered unless made on forms supplied. Forms will be mailed upon request to the Superintendent.

A marked cheque covering five per cent. (5 p.c.) of the amount of the bid (made payable to the City Treasurer) must accompany each tender.

The City Commissioners reserve the right to reject any or all tenders.

R. MARTIN, Mayor.
G. A. MANTLE,
L. A. THORNTON,
City Commissioners.

WESTON
A. C.

Ammeters and Voltmeters, Wattmeters, Synchroscopes, Power Factor Meters and Frequency Meters, constitute a line of Switchboard Alternating Current Indicating Instruments which is unequalled. Send for our Catalogs giving full description of these instruments. They are accurate—durable—dependable—and we stand back of them.

Weston Electrical Instrument Company, Main Office and Works NEWARK, N. J.

New York, 114 Liberty Street.
Chicago, 1504 Monadnock Blk.
Boston, 176 Federal Street.
Philadelphia, 342 Mint Arcade.
Birmingham, Brown Marx Bldg.
Detroit, 44 Buhl Block.

St. Louis, 915 Olive Street.
Denver, 231 15th Street.
San Francisco, 682 Mission St.
New Haven, 29 College Street.
Cleveland, 1729 E. 12th Street.

Toronto, 76 Bay Street.
Winnipeg, Montreal, Calgary, Vancouver } Northern Electric

London, Audrey House, Ely Place, Holborn.
Paris, 12 Rue St. Georges.
Berlin, Genest St. 5, Schoenberg.
Johannesburg, So. Africa, F. Peabody Rice, Standard Bank Buildings, Harrison St.

Sparkless Commutation Demands

CERTAIN, DEFINITE BRUSH RESISTANCE

depending upon the design of the motor or generator. Further—

A Definite Degree of Abrasiveness

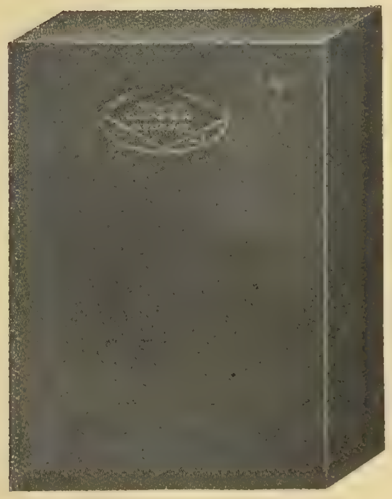
IS NECESSARY IN BRUSHES

to keep the mica insulation of the commutator flush with the copper segments.

TUNGSTEN

PURE CARBON BRUSHES

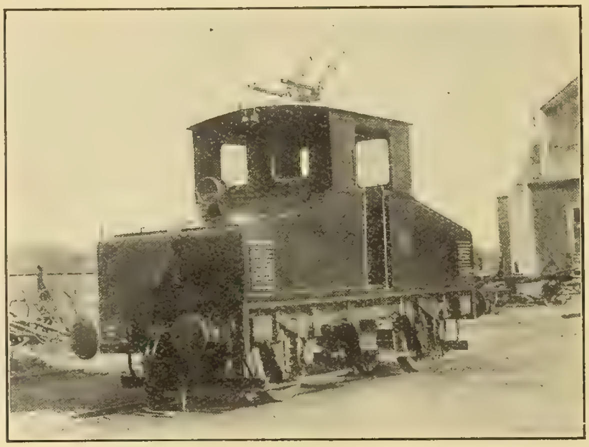
are classified in an entirely new way which makes it easy to select the brush best suited to your service. We classify brushes with respect to voltage, current density, resistance per cubic inch and abrasiveness—the latter under seven divisions.



Pure Carbon Company, Wellsville, N. Y.

Engineering Works of Canada, Limited

Head Offices: New Birks Building, MONTREAL, QUE.



Three Phase Electric Locomotive

All kinds of

Mechanical and Electrical Machinery

Builders under the patents of the

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ESTABLISHED 1826

AUTOMATIC ELEVATORS—Passenger and Freight

Simplicity Foolproof High Efficiency Patent Single Phase Motor High Starting Torque

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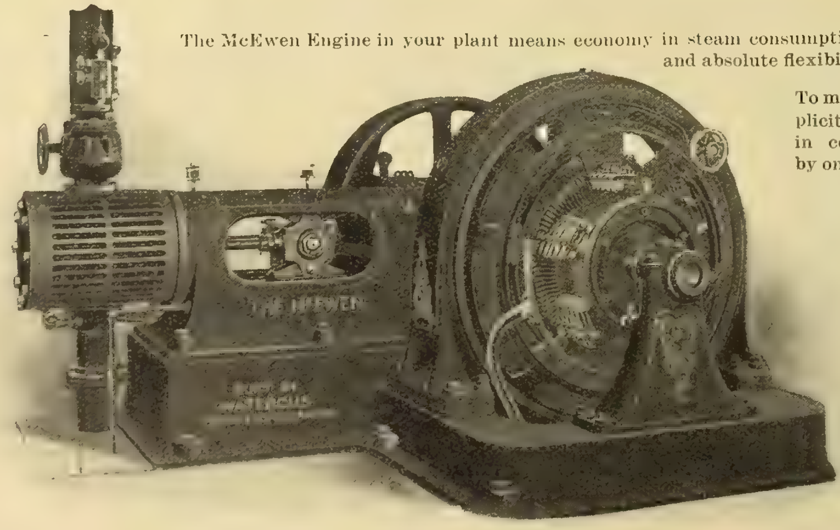
The McEWEN HIGH SPEED AUTOMATIC ENGINE

Continuous Service for the Isolated Plant



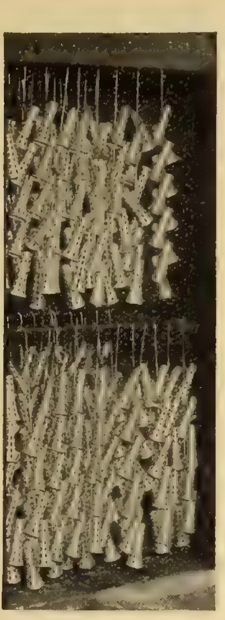
The McEwen Engine in your plant means economy in steam consumption, great range of power at command, and and absolute flexibility under all conditions.

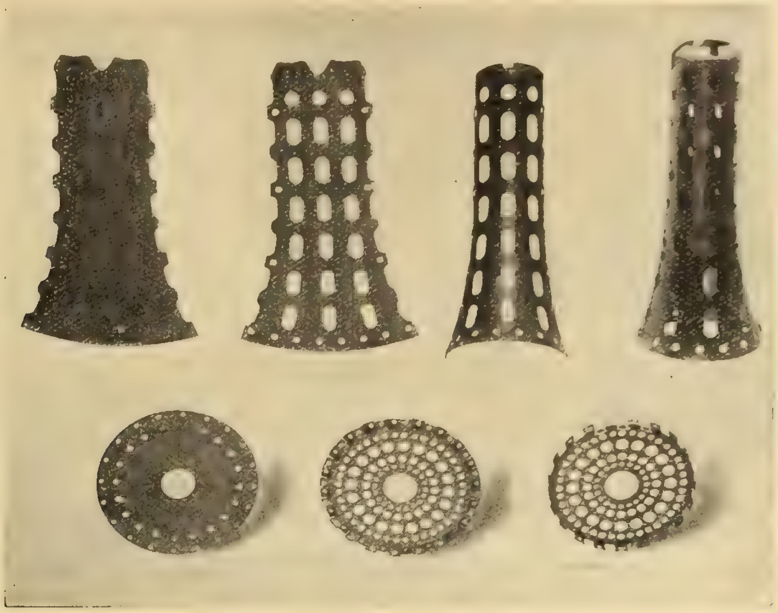
To make this possible the McEwen combines simplicity and accessibility of all parts, great strength in construction, and a guaranteed regulation by one of the best automatic fly wheel governors — the Begthrup — on the market to-day.

The McEwen Engine is particularly adapted for producing electric light and power economically. In this class of work its ability to absorb overload and its instantaneous regulation make it an ideal installation. Hundreds of isolated plants in Canada testify to this.

Built in simple and compound units up to 700 H. P. Let us send you our catalogue and list of Canadian users. **It will convince you.**

The Waterous Engine Works Co., Limited, Brantford, Canada





THE BACKBONE OF KELLOGG RECEIVERS

In the past, exchange managers have always had frequent annoyances and expense from broken receiver shells and mouthpieces. Valuable time was lost in replacing them.

A few years ago the Kellogg Company started to manufacture receivers and transmitters with special metal reinforcing. They were well received—became the admiration of every telephone man, and there has been a steadily increasing demand for them ever since.

Wishing You a Successful New Year

In the making of these receivers and mouthpieces the rubber insulation is forced around the steel frame by means of special machinery. The receiver cap is reinforced in a similar manner with the metal perforated disk, flanged at its circumference. (See lower part of right hand illustration). The flanges protect the threads and rim of the receiver while the perforations in the metal hold the insulation intact.

The illustration in the upper left hand corner of this page is of a bunch of these reinforced parts in an oven. These have just been baking for forty minutes in order to eliminate all chemical action, after having been copper plated.

Our reinforced receivers and mouthpieces had not long been in the market before they became known as the "Unbreakable Receivers" or the "Unbreakable Mouthpieces." Large operating companies order them in large quantities because they realize the greater economy.

Do you wish to be freed from the expense and annoyance of replacing receivers and mouthpieces every little while? Try out the Kellogg rubber jacketed, steel reinforced receiver.

KELLOGG SWITCHBOARD & SUPPLY COMPANY

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KANSAS CITY CHICAGO SAN FRANCISCO

Our Canadian Representatives

At Winnipeg - HOUSTON & CO.
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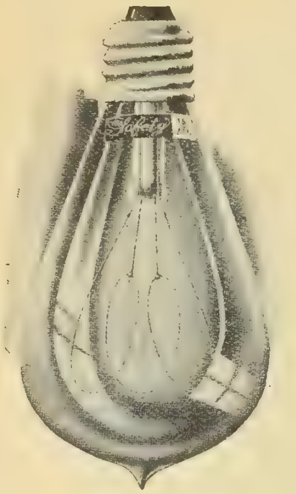

Tungsten Lamps

Immediate delivery. American shapes. An awfully good lamp. Send for a trial lot, at case lot price.

Carbon Lamps

The same lamp we have always handled. We couldn't improve on the quality if we tried. The price is also right.

Other Agencies

Hotpoint Electric Irons, etc., Rollinson Bell Ringers, Transformers and Rectifiers, Cutter Flush Switches, Plates and Receptacles, "Brookduct" (Circular Loom), Prismatic Shades. Switch Boxes, Fuses, etc. Stromberg Electric Time Clocks and Cost-Keeping Machines.

E. A. Greene Co., Limited
145 Church Street, Toronto
Tels. Adelaide 2240, 2241

Special Prices on Electrical Books

The Following Books are Offered Subject to Previous Sale

The Steam Turbine, by Robert M. Neilson. Published in 1903 by Longmans, Green & Co., 294 pages, illustrated. Price $1.00.

Telegraphy, bp Sir W. H. Preece, K.C.B., and Sir J. Sivewright, M.A. Published in 1905 by Longmans, Green & Co., 504 pages. Price $1.00.

Electro-Dynamos, by Charles Ashley Carus-Wilson. Published in 1898 by Longmans, Green & Company. 298 pages, Price 50c.

Elementary Lessons in Electricity and Magnetism, by Silvanus P. Thompson. Published in 1895 by MacMillan & Company, 628 pages, illustrated. Price 50c.

Electric Lighting & Heating, by Sydney F. Walker, Published in 1907 by Norman W. Henley Publishing Company. 438 pages, illustrated. Price $1.00.

Dynamo-Electric Machinery, by Francis B. Crocker, E.M., Ph.D. Published in 1908 by American School of Correspondence. 236 pages, illustrated. Price $1.00.

Telephone Law, by A. H. McMillan. Published in 1908 by McGraw Publishing Company. 332 pages. Price $1.50.

Explanations of Switch and Signal Circuits. Published in 1907 by Doran & Kasner. 140 pages. Price 40c.

Elementary Electrical Calculations, by W. H. N. James, A.R.C.Sc. Published in 1905 by Longmans, Green & Company. 216 pages, illustrated. Price 50c.

Practical Alternating Currents and Power Transmission, by Newton Harrison, C.E. Published in 1906 by W. L. Hedenberg Publishing Company. 376 pages, illustrated. Price 50c.

Practical Methods of Electro-Chemistry, by F. M. Perkin, Ph.D. Published in 1905. 322 pages. Price $1.00.

Treatise on Thermodynamics, by Dr. Max. Planck. Published in 1903. 272 pages. Price $1.00.

Text-Book of Electrochemistry, by Svante Arrhenius. Published in 1902. 344 pages, illustrated. Price $1.00.

HUGH C. MacLEAN, LIMITED
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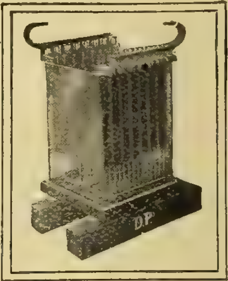

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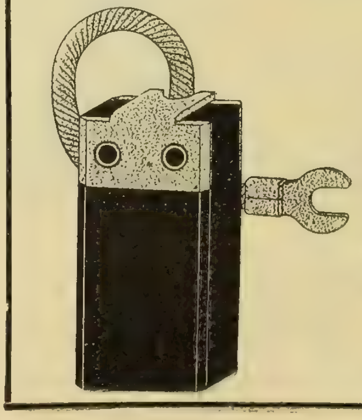

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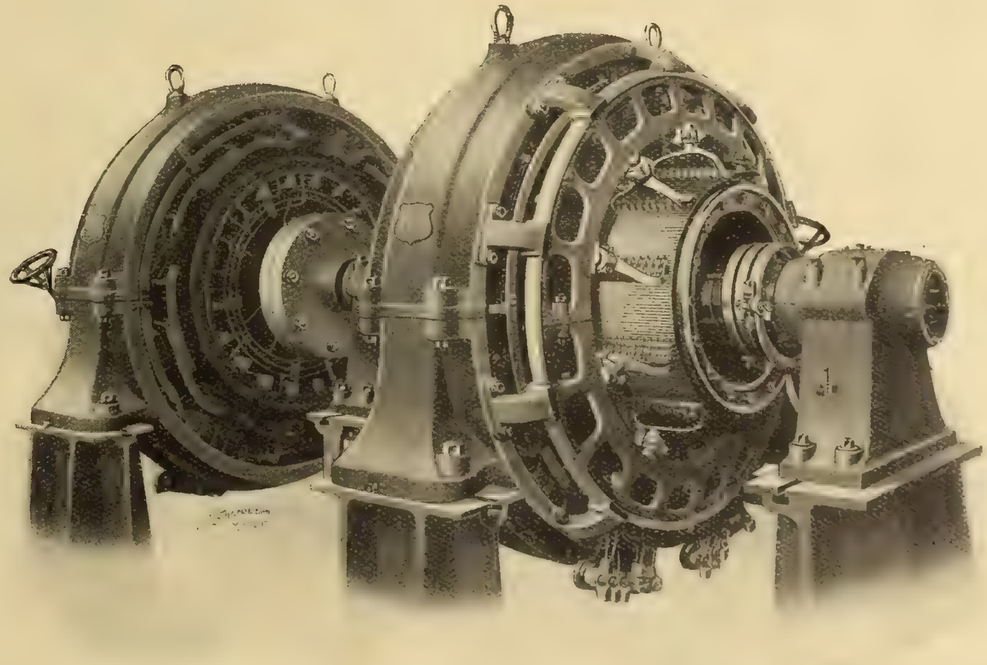

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Lamps, Sockets, Rosettes, Wires, Cords, Conduit, Moulding, Switches, Cut-Outs, Fixtures, etc., etc.

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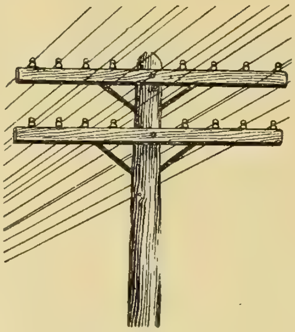

Our specialty is manufacturing Cross-Arms from sound straight-grained Douglas Fir.

No order too large for us to fill nor too small to receive careful attention.

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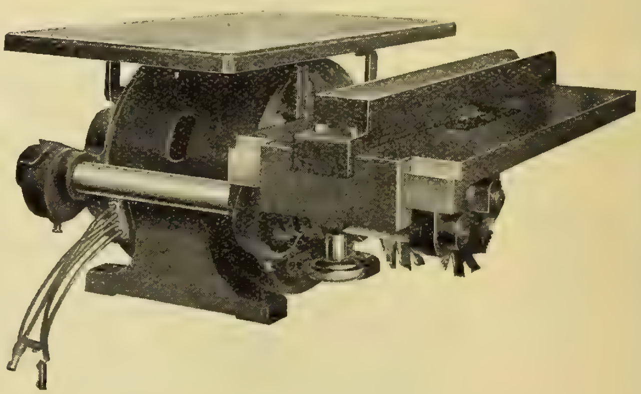
Mills and Office - - VICTORIA, B. C.

Hundreds of *Century* **Single-Phase Motors**

are in daily use operating woodworking machinery of every kind and type.



2 H. P. motor specially adapted to a tongue and grooving machine.

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IN B. C., IDAHO AND WASHINGTON. WE SHIP FROM OUR

British Columbia Stocks

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Quebec Ontario Manitoba
Alberta and Saskatchewan Points

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Western Lumber & Pole Co.
Main Office : DENVER, Colo.

Cedar

Crawford Poles

in life, strength and appearance are all that telephone buyers can ask. Price is O. K. Write

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are designed and made to give the maximum efficiency under the most severe conditions. Uniform glaze, body and appearance. Made for voltages from 4,000 upward.

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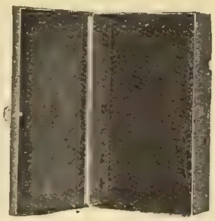
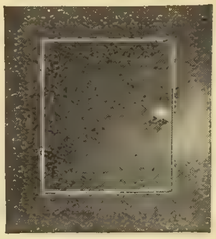
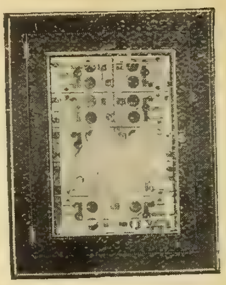


Type A. The usual box. Dust tight cover.



Type P. A cheap box with a door and trim.



Type C. A better one—beaded and paneled.

Type G. With a beveled plate glass panel in door.

Type SW. Steel, with natural oak, mahogany or walnut finish.

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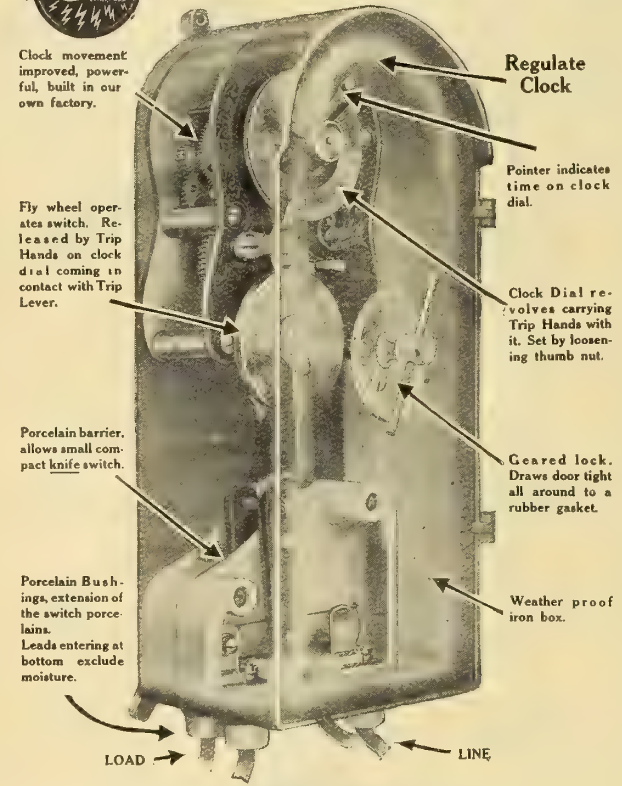
Lower Priced. Get Acquainted Now. Write: COLUMBIA, 226 E. 144th ST., NEW YORK

CAMPBELL TIME SWITCH

THE BEST (PATENT)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Regulate Clock
Pointer indicates time on clock dial.
Fly wheel operates switch. Released by Trip Hands on clock dial coming in contact with Trip Lever.
Clock Dial revolves carrying Trip Hands with it. Set by loosening thumb nut.
Porcelain barrier, allows small compact knife switch.
Geared lock. Draws door tight all around to a rubber gasket.
Porcelain Bushings, extension of the switch porcelains.
Leads entering at bottom exclude moisture.
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Canadian Representative—Irving Smith, 406-7 St. Nicholas Bldg., Montreal

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Electrical Material

Enclosed Fuses
Fuse Blocks
Porcelain Cutouts
Fuse Wire and Ribbon
Fuse Links

Ground Connection Clamps
Nipples and Couplings
Stage Pockets and Plugs
Metal Cable Clips, Etc.

Manufactured by

CHASE - SHAWMUT CO.

Newburyport, Massachusetts

FRANK G. SCOFIELD

REPRESENTATIVE FOR ONTARIO

702 LUMSDEN BLDG. - TORONTO, ONT.

Buy National Wirum Lamps

The kind that do not break and the only ones to retain their ductility through life

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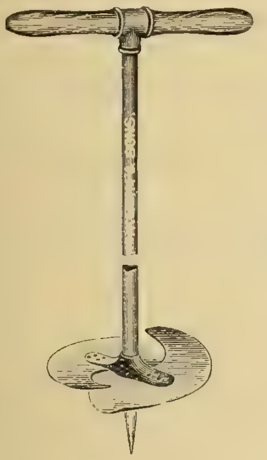
We can furnish any quality of arms, pins, brackets, or pole line hardware you call for if you can wait for factory shipment, but stock only which carries our guarantee.

Superior

This includes: Washington Fir not less than 85% heart, Georgia Pine—Long Leaf—not less than 75% heart Kyanized—Spruce. Pins and Line Hardware—A T and T specifications.

STUART-HOWLAND COMPANY
131 to 141 Federal St., - BOSTON



Post Hole Auger

This style of auger is simple, strong, lasting and withall Efficient.

Sizes No. 396—12" 6' stem,
No. 396-A — 14" 6' stem,
No. 396-B — 14" 8' stem,

For lightness, strength and durability we like this pattern. It will work its way rapidly in soil of a free texture, Sand, Clay or Loam. It is simple in construction and not at all delicate. It can be handled vigorously and accomplish results.

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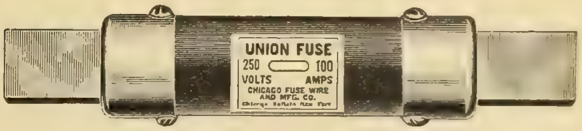

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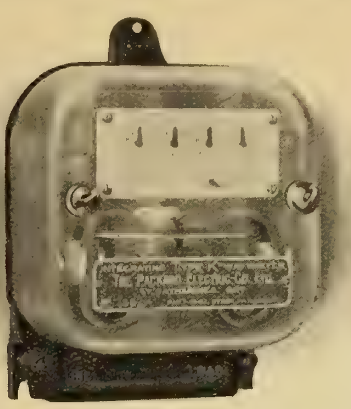

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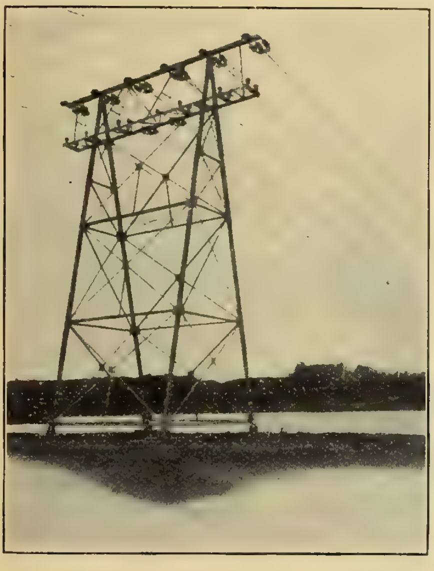

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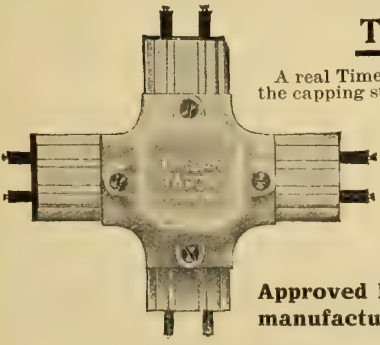

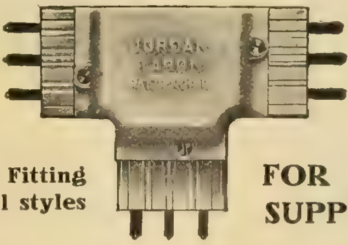

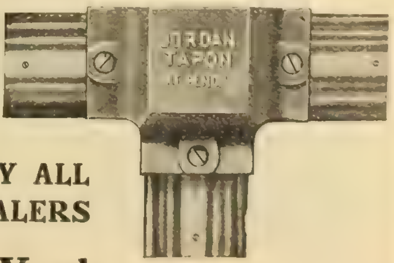

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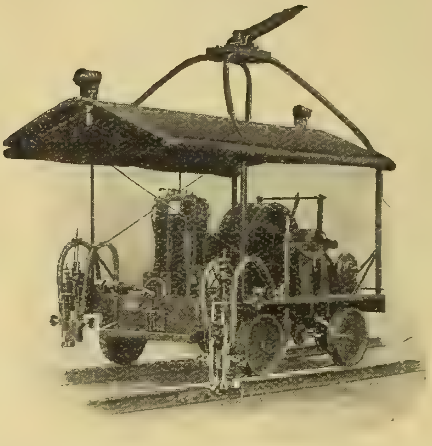

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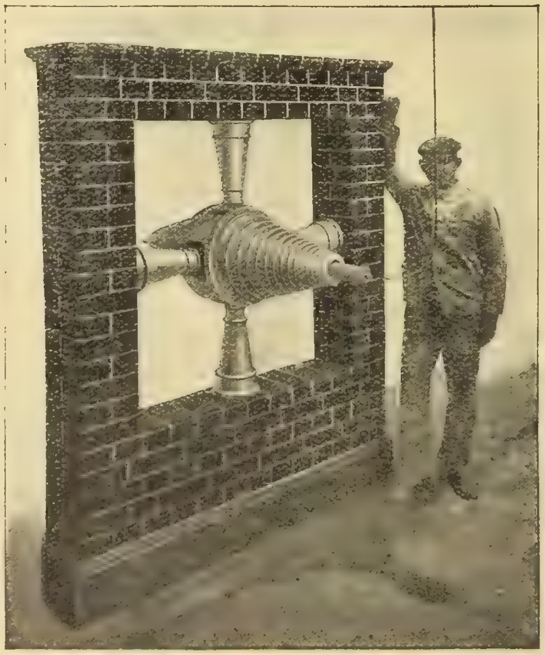

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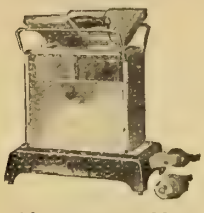

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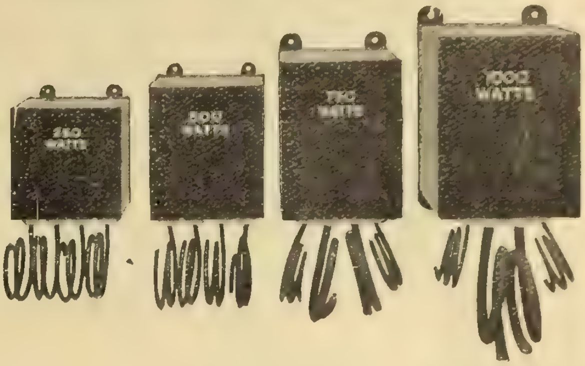

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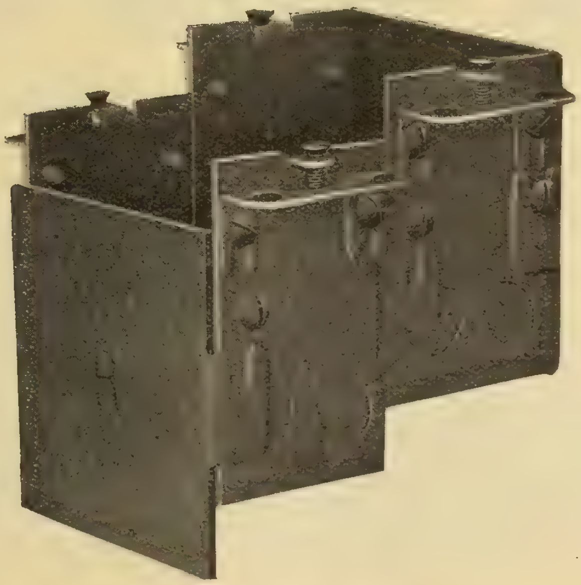

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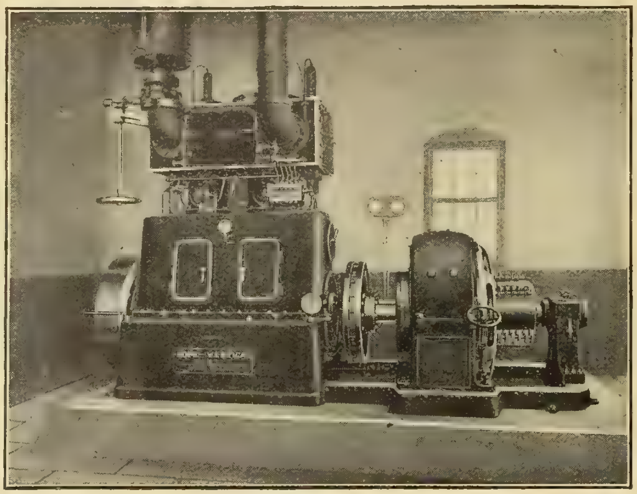

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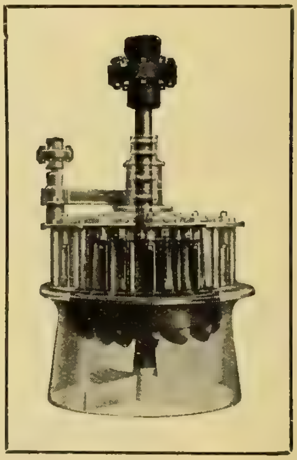

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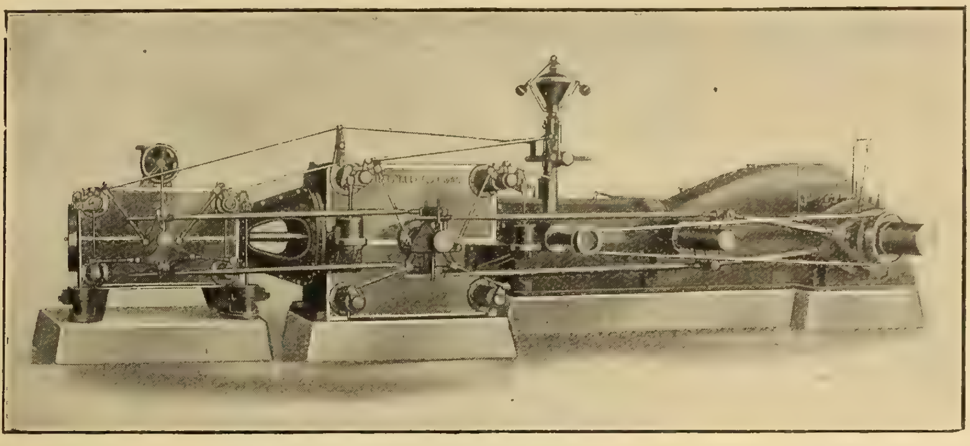

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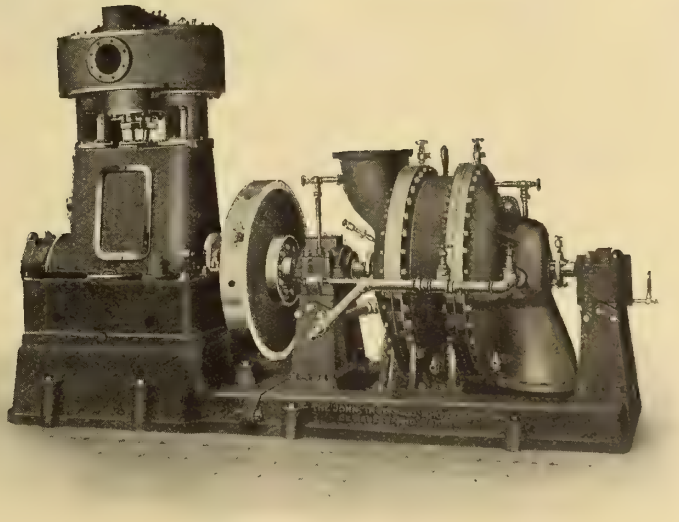

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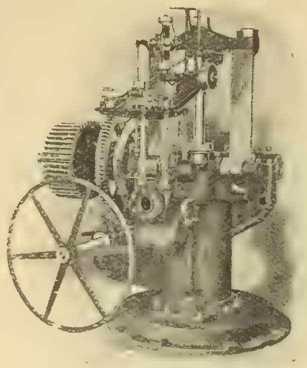

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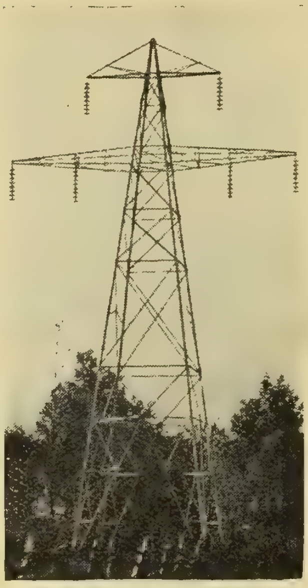

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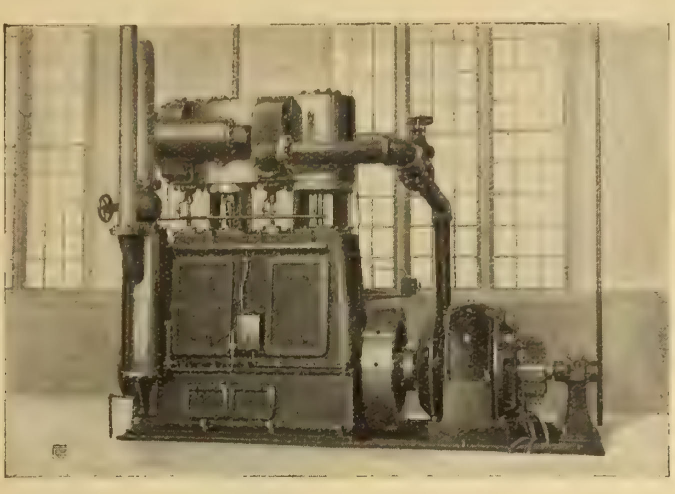

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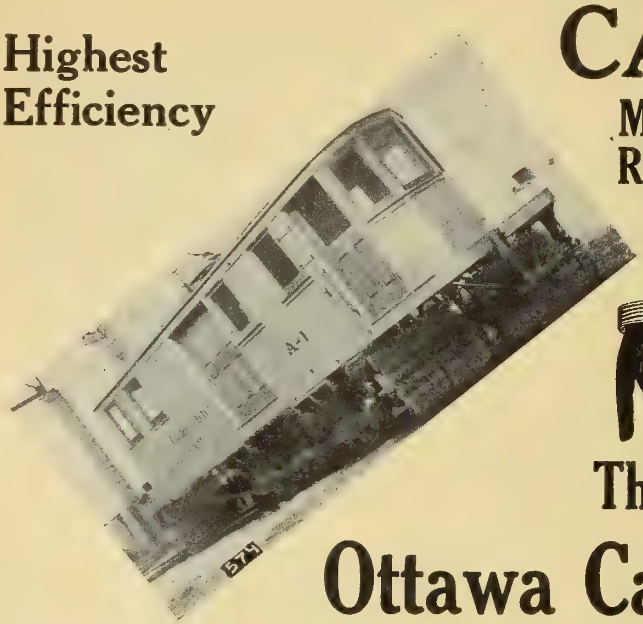

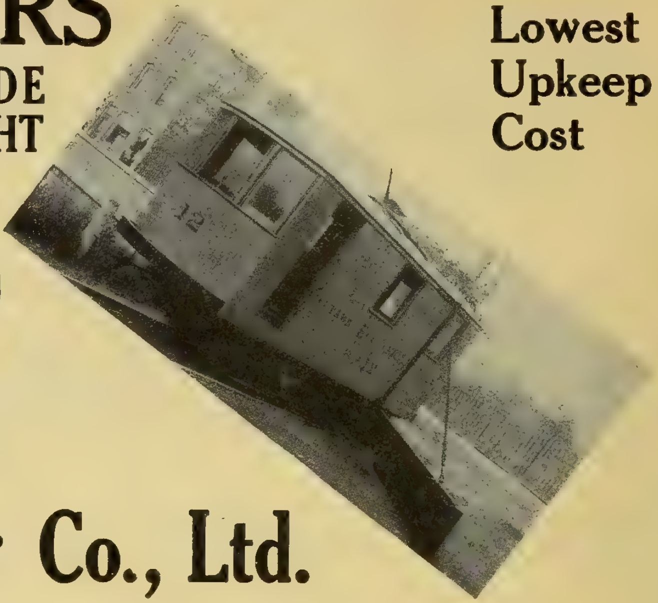

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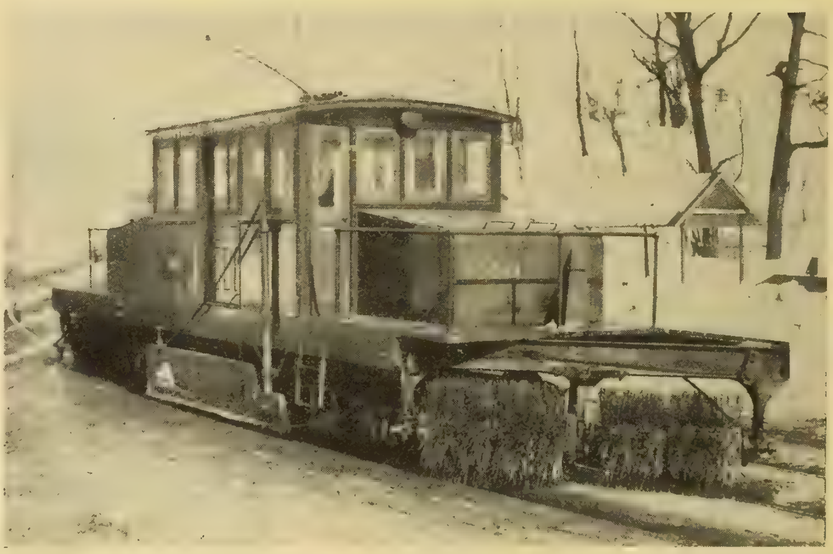

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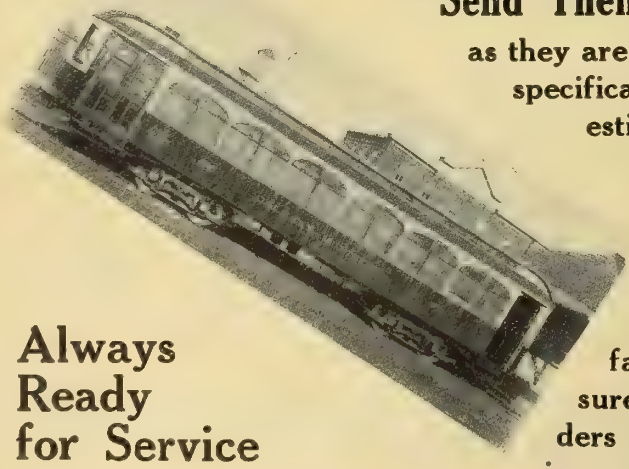

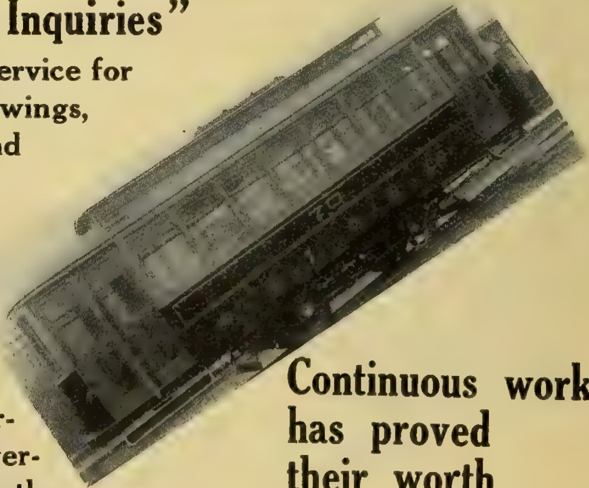

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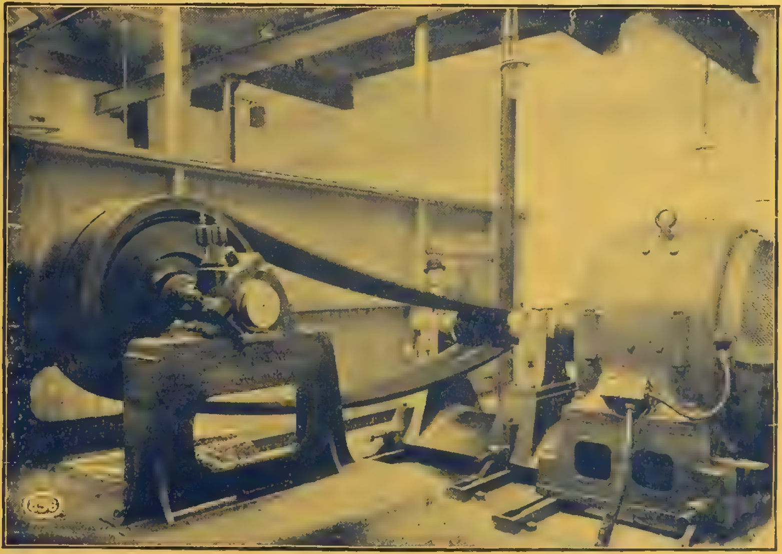

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REFLECTORS, LANTERNS, SEMI - INDIRECT BOWLS AND BALL GLOBES

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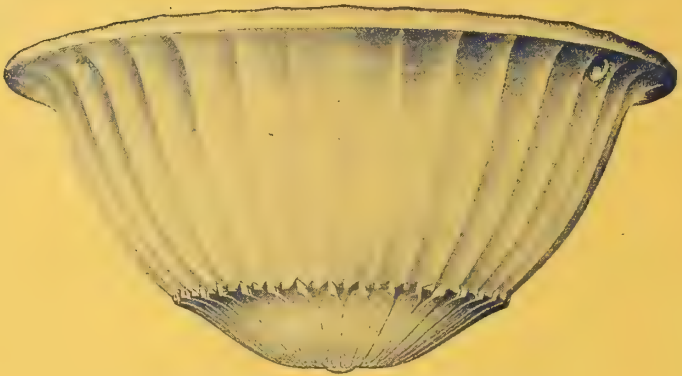


No. 6023—14″ Luceo Semi Indirect Bowl
No. 6027—16″ Luceo Semi Indirect Bowl

LUCEO GLASS is Blown and moulded in many beautiful and decorative designs which will give the highest possible efficiency where used in connection with light source of great brilliancy. Luceo glass is specially adapted for home and commercial lighting. We make a specialty of Street Lighting Glass, no other glass can compare with Luceo for effective Street Illumination. Your inquiries regarding any specialties in glass are earnestly solicited. Have your architects specify Luceo if you would have the best.

No. 1263—Luceo Lantern 12 x 6
Furnished in 5 sizes

No. 4029—Luceo 250-400 Watt

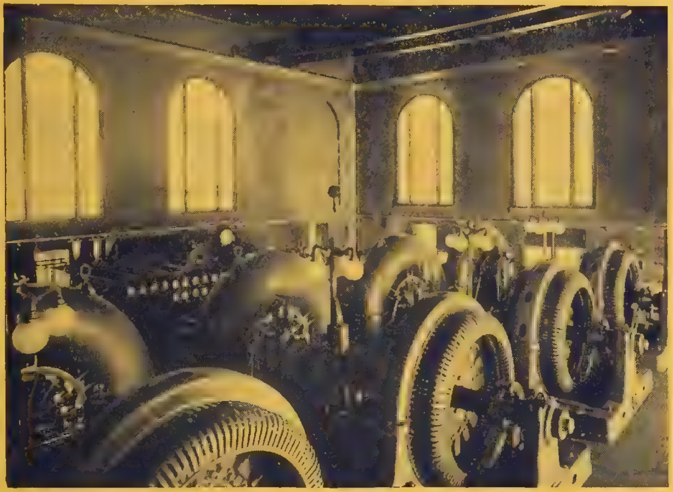
The Jefferson Glass Company
Limited

MADE IN CANADA

TORONTO CANADA

Electrical News

Generation, Transmission and Application of Electricity



"Smith" Francis Turbines

Power house of the Metropolitan Water and Sewerage Board, Clinton, Mass. (now owned by City of Boston), where we have four hydraulic turbine units, each of 1600 Horse Power, under 100 ft. head, in constant operation. Turbines designed for heads from 5 feet to 600 feet.

SEND FOR BULLETIN N

S. Morgan Smith Co., York, Pa.

Branch Offices: 176 Federal St., BOSTON, MASS.
644 American Trust Bldg., CHICAGO

Use 3 lights at the old cost of One

For the same money that you now pay for current for the old-style carbon lamp, you can have your choice of

3 times as much light in each room—or
3 times as many rooms lighted—or
3 times as many hours of light

if, instead of the carbon lamp, you use

C. G. E. MAZDA LAMPS

Canadian General Electric Co., Limited

Head Office: TORONTO

Montreal Halifax Ottawa Cobalt South Porcupine Winnipeg Calgary Vancouver Victoria Nelson Prince Rupert

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PHILLIPS

Electrical
Wires and Cables

Bare and Insulated Copper Wires and Cables.

Bare and Insulated Electric Wire and Cables for Aerial and Underground Use.

Railway Feeder and Trolley Wire.

Weatherproof Magnet and Rubber Covered Wires and Cables.

Incandescent and Flexible Cords.

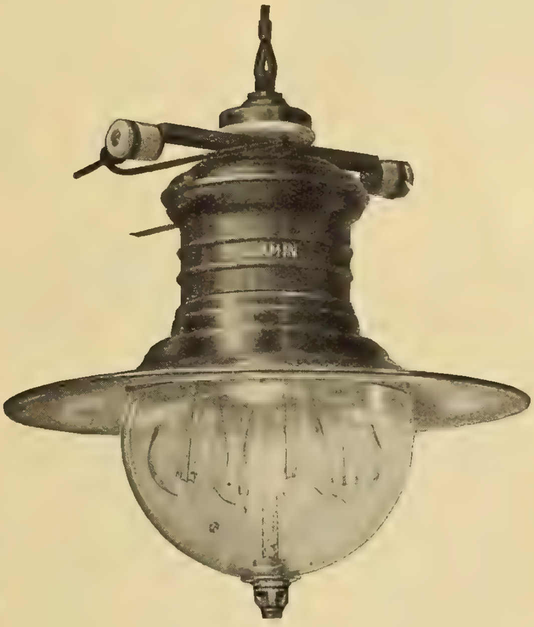
Telephone, Telegraph, Lighting, Power and Street Railway Wires, Cables and Equipment.

Eugene F. Phillips Electrical
Works, Limited
MONTREAL - - CANADA
Branches: HALIFAX TORONTO WINNIPEG VANCOUVER

BENJAMIN
Electrical Devices

CANADIAN MADE

Sockets
Receptacles
Reflectors
Clusters
Fittings
Specialties



Switches
C-H Devices
Wirt Joints
Fixtures
Screw-Drivers
Specialties

Carried in Stock by your Jobber

Benjamin Electric Mfg. Co.
of Canada, Limited
11-17 Charlotte Street, TORONTO, ONT.

Power Logic

Reduced Loss
Increased Profit

Ferranti Transformers

Three Phase Pole or Station Transformers

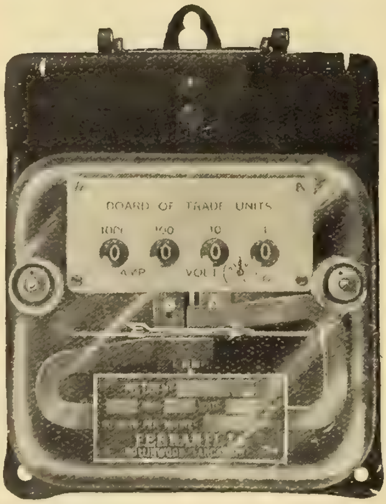
The Transmission line that is equipped with Ferranti three phase transformers is always a profitable one because of the great reduction in energy-loss made possible by these efficient transformers.

All coils are wound with copper of ample sectional area, thereby reducing copper losses to a minimum.

Three phase transformers are the most economical type to operate and will effect a considerable saving in construction costs.

Write us for particulars

Ferranti Meters



Glass Case—Top Connections

Simplicity of construction.
Perfect accuracy.
Cyclometer or clock dials.
Top or bottom connections.
Prompt deliveries.

Every meter carefully inspected before shipment.

Absolutely guaranteed.

Send us your probable meter requirements and let us make you a proposition.

Large stock and fully equipped repair and erection Shops at Toronto and Winnipeg.

Steel Case—Top or Botto mConnections

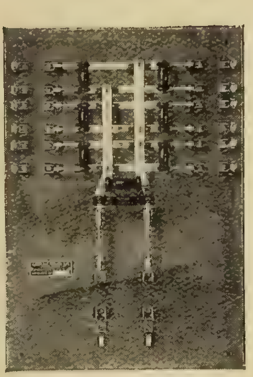
The Ferranti Electrical Co. of Canada, Ltd.

TORONTO
90 Sherbourne St.

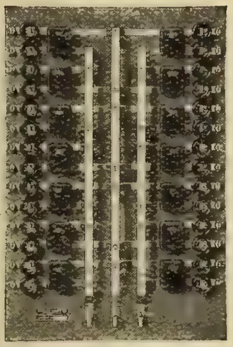
WINNIPEG
56 Albert St.

Panel Boards and Cabinets

That Embody Advanced Structural Principles
Material and Workmanship, the Best



Type A Panel



Type H Panel

Our line of Panel Boards includes four distinct types, each made in single and double branch forms, with mains carrying lugs only, fuses, fuseless knife switch, and fused knife switch for 2 to 2 and 3 to 2 wire systems. Three to 2 wire Panel Boards are made in convertable form, as well as the standard construction.

Type "A" Panels [125 and 250 volts]—Branches arranged for enclosed fuses and with or without knife switches.

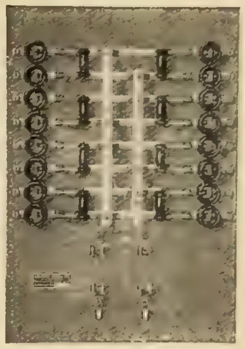
Type "D" Panels [125 volts]—Branches arranged for plug fuses and with or without knife switches.

Type "F" Panels [125 and 250 volts]—Branches arranged for enclosed fuses and with snap switches

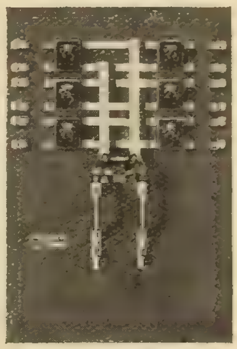
Type "H" Panels [125 volts]—Branches arranged for plug fuses and with snap switches.

Our designs in Cabinets embrace fifteen types—all steel, steel and wood combined, and wood with slate lining, either for flush or surface mounting, and with side or back gutters, also without gutter.

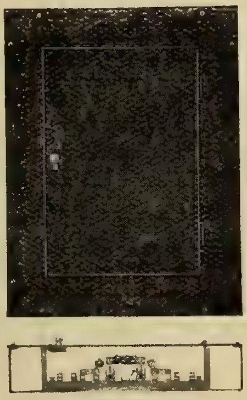
If your dealer does not stock them, write us
"Panels and Cabinets," Bulletin No. 1, sent free upon request



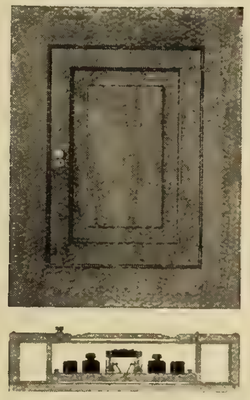
Type D Panel



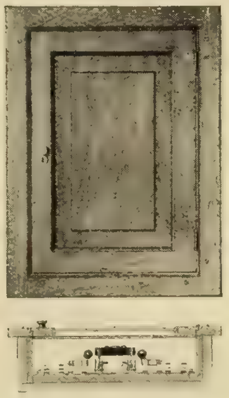
Type F Panel



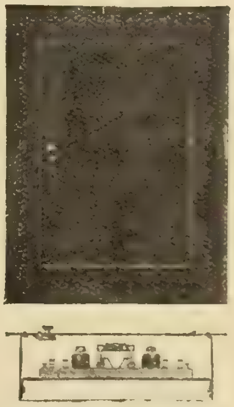
Type BM Cabinet



Type DFP Cabinet



Type ESQ Cabinet



Type CL Cabinet

Crouse Hinds Co., of Canada, Limited

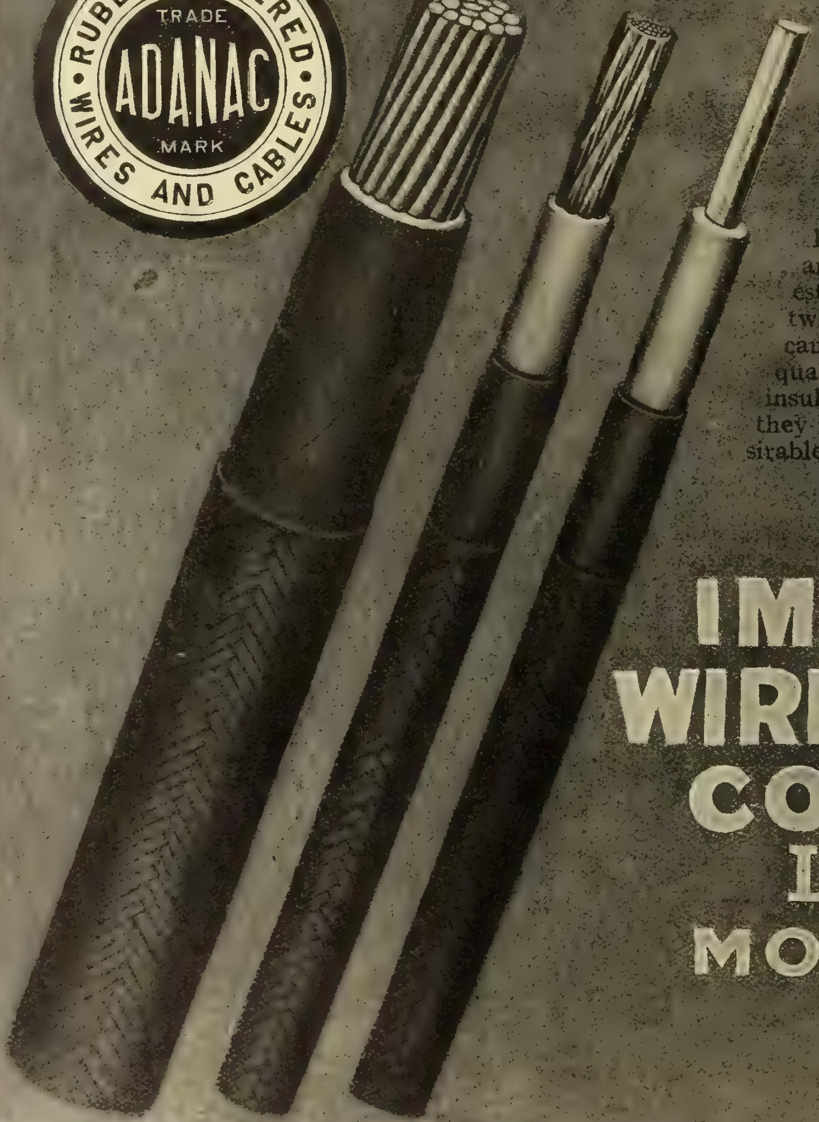
Main Office and Works:

Toronto, Ont., Canada

ADANAC Red Core Rubber Covered

WIRES & CABLES

RUBBER COVERED • WIRES AND CABLES •
TRADE
ADANAC
MARK



Adanac Red Core Rubber Covered Wires and Cables

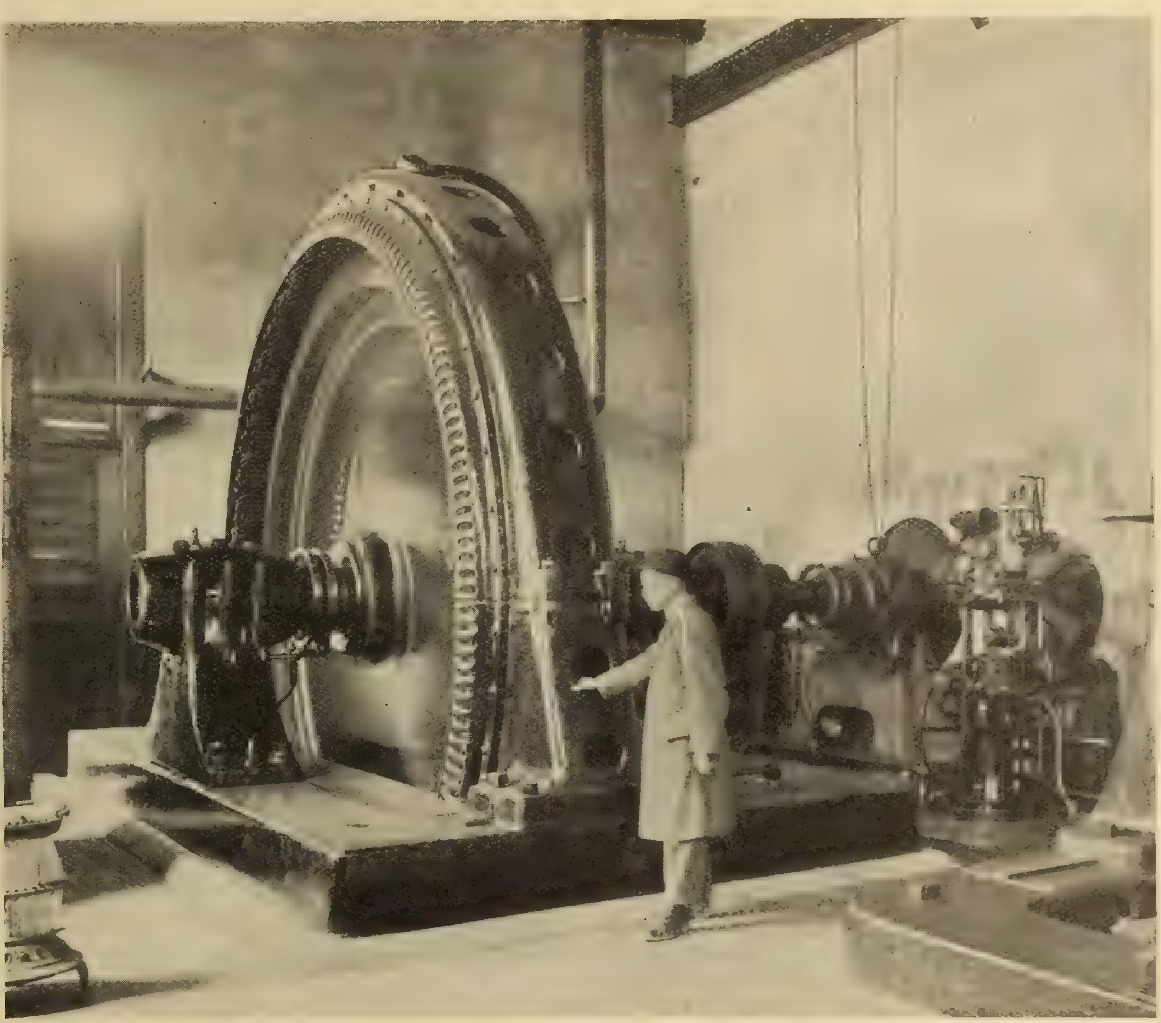
are made according to the specifications of the National Board of Fire Underwriters. The conductors are drawn from copper of the highest conductivity and are covered with two thicknesses of thoroughly vulcanized rubber compound of high quality. The wires are braided over insulation and the smooth high finish they receive makes them specially desirable for conduit work.

IMPERIAL WIRE & CABLE COMPANY Limited MONTREAL

THE Northern-Electric AND MANUFACTURING CO. LIMITED
SALES AGENTS

TORONTO WINNIPEG
REGINA
CALGARY VANCOUVER

High Grade Electrical Apparatus



1,250 K.W., 120 r.p.m., 2,400 Volts, 3 Phase, 60 Cycle Water Wheel Type Generator installed 1910 for the Seymour Power and Electric Co., Campbellford, Ont.

Kilmer, Pullen & Burnham,
LIMITED

Head Office,
TORONTO

Branch Offices: MONTREAL
General Supplies Ltd.,
CALGARY, ALTA.

SOLE DEALERS FOR
The General Electric Co., of Sweden

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The Best Endorsement of the value of the "Electrical News" as an advertising medium is the above List of Advertisers

Men Who Know Conduits

Invariably Specify

"Galvaduct" and "Loricated"

Windsor Station, Montreal—A Galvaduct Building

THE CONDUIT QUESTION?

Every exacting engineer and architect is vitally interested in Conduits because the question of conduit protection is an absolute necessity in modern building and engineering practice.

We are prepared to submit convincing proof that **"GALVADUCT" and "LORICATED" Conduits** give longer life, better service, and more clearly meet the conditions for which they are made than any other conduits produced.

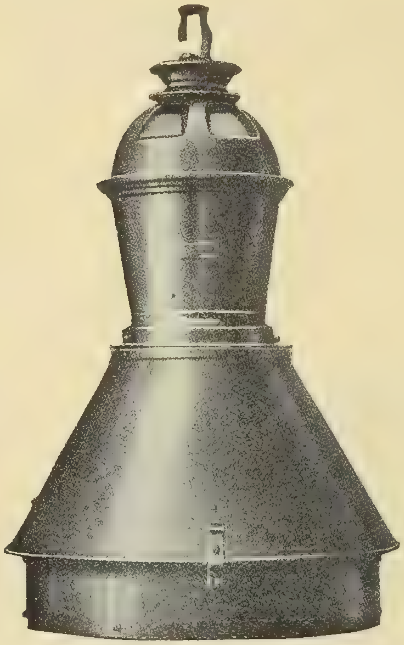
If your jobber cannot supply you, write us

Conduits Company Limited

Toronto and Montreal

C. G. E. Color Matching Outfit

A necessity for the man whose business requires the perfect matching of colors.



COLOR MATCHING OUTFIT

INCREASE PRODUCTION by having available a Color Matching light 24 hours every day.

The spectrum of the C. G. E. Color Matching Outfit is like that from a clear north sky.

The use of the C. G. E. Color Matching Outfit removes the natural limitations imposed upon production, and "rush" orders can be accepted with the assurance that the colors can be properly matched at any time of the day or night, because the light is unchanging and the manufacturer is enabled to maintain the highest grade of uniformity in the process of color matching.

It is Simple
Inexpensive to install
Economical to Maintain
Requires no more attention than any ordinary arc lamp

TURN a switch and you have available a light perfect for the matching of colors.

This device is indispensable to textile mills, pulp mills, dye works, lithographers, manufacturers of dye stuffs, department stores and in fact any establishment whose output is dependent upon the proper matching of colors.

The outfit is very simple and consists primarily of an intensified arc lamp with a special casing and a combination of a diffusing and several absorption glasses. The function of these glasses is to reduce the slight excess of red, orange and violet rays found in the spectrum of the intensified lamp, so that standard daylight is faithfully reproduced.

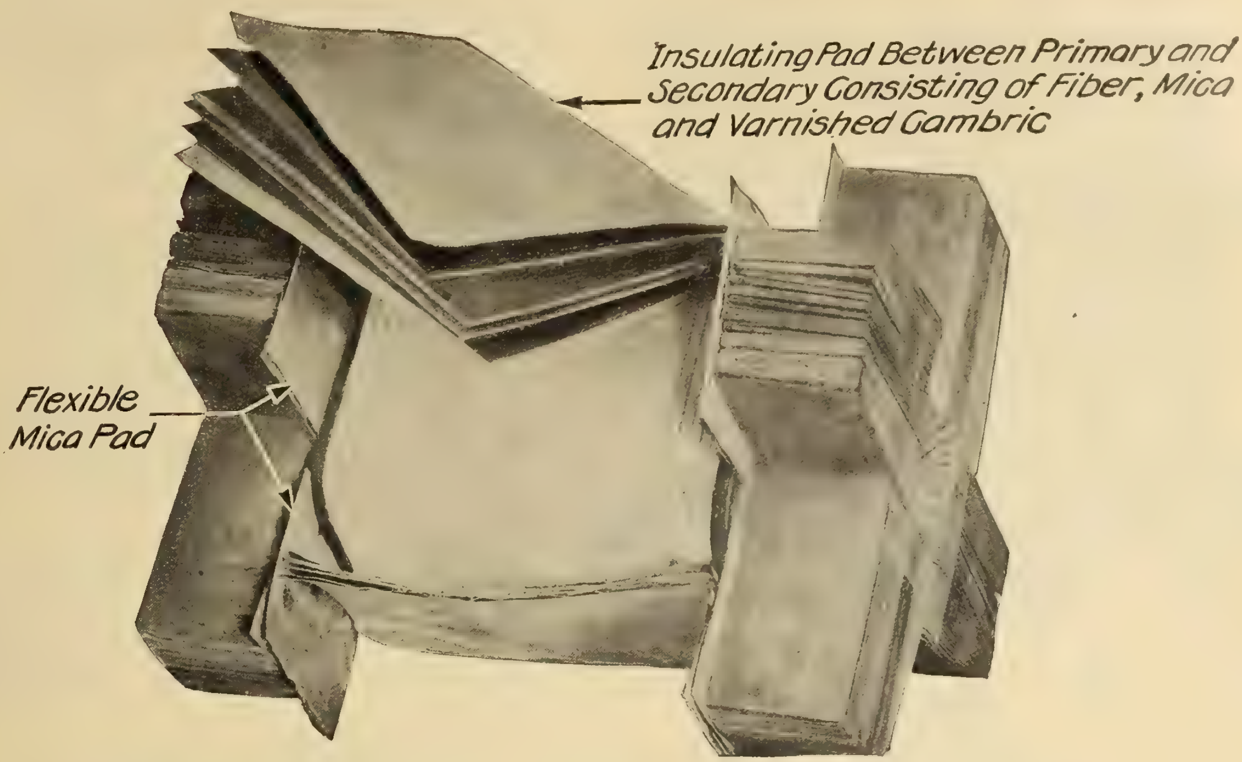
COLOR MATCHING OUTFIT
with Color Screen Lowered

WRITE OUR NEAREST BRANCH OFFICE FOR PRICES AND FURTHER PARTICULARS

Canadian General Electric Co., Limited

Head Office: TORONTO

Montreal Halifax Ottawa Cobalt South Porcupine Winnipeg Calgary Vancouver Victoria Nelson Prince Rupert


Insulating Pad Between Primary and Secondary Consisting of Fiber, Mica and Varnished Cambric
Flexible Mica Pad

Reliable Transformer Insulation

The vital parts of the Type "H" transformer are protected by composite insulations which involve the liberal use of mica.

Fibrous insulations are weakened and may be destroyed by abnormal temperatures. Mica, under like conditions, maintains its original insulating value.

Fibrous insulations tend to absorb moisture, which greatly reduces their dielectric strength, while mica, under similar conditions, is unaffected.

Fibrous insulations properly proportioned offer great resistance against momentary surges. In combination with mica, one reinforces the other, resulting in an insulation sufficient to meet every normal or abnormal condition of service.

Mica has contributed largely to the reputation of the Type "H" for permanence and reliability. When insulating material superior to mica is found it will be incorporated in the Type "H" transformer.

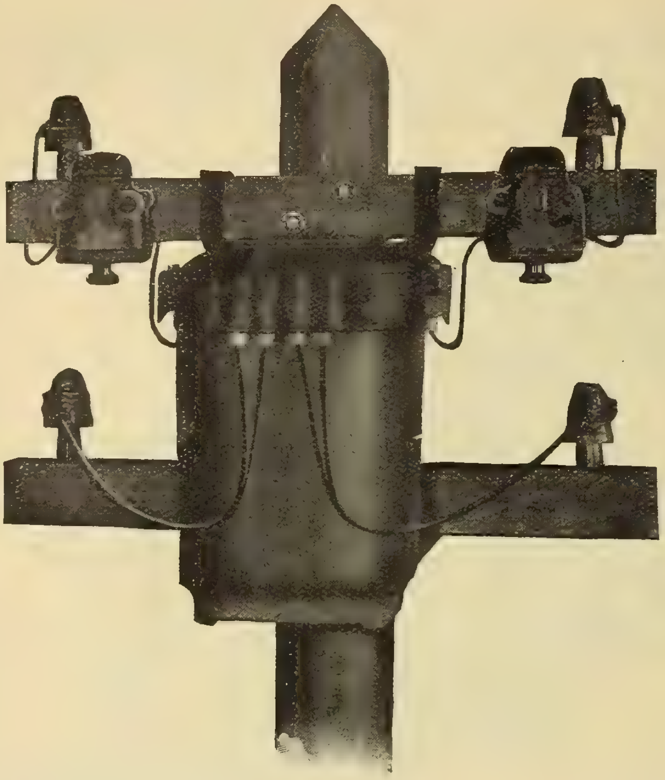
If you are considering transformer investments—***Look for the mica.***

The transformer of longest life.

Canadian General Electric Co., Limited

Head Office: TORONTO

Montreal Halifax Ottawa Cobalt South Porcupine Winnipeg Calgary Vancouver Victoria Nelson Prince Rupert



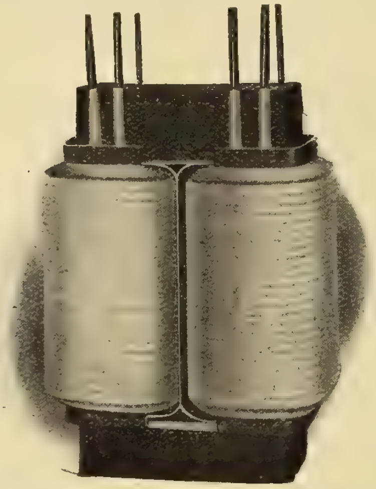
Moloney High Efficiency Transformer in position on pole showing method of wiring

High Commercial Efficiency

is the sum total of what is required in transformers—the knowledge that the current is not being wasted in transformation—that the core and the copper loss is low with a low temperature rise and a high and permanent insulation—that the construction is strong and the workmanship is faultless. All this is necessary and what is required in transformers. All this is what is given in the highest degree in

Moloney

High Efficiency Transformers



Interior view of Moloney High Efficiency Transformer

Before you decide on the purchase of transformers let us figure out some transformer costs for you. Let us **show you how** Moloney transformers effect a **direct saving** over any other method on account of their high-commercial-all-day-efficiency.

Write for new catalogue giving full data and all information

Canadian Moloney Electric Co., Limited

Office and Works: WINDSOR, ONT.

COMPLETE STOCKS:

WINDSOR WINNIPEG VANCOUVER

Electrical Department of the Toledo Auto and Garage Co., Toledo, Ohio

How Would You Like to Have the Charging of this Garage ?

Mr. Central Station Manager, suppose there was ***just one*** Electric Vehicle garage like this in your territory—or several smaller ones of equal total car capacity. Wouldn't a business like that help to fill up the valleys on your load chart—increase your operating efficiency—effect economy ? Then why not start in right now to interest your public in the superior advantages of the Electric Vehicle ? Surely the benefits you will derive from the increased use of Electric Vehicles are well worth the slight effort it will take on your part. Conditions were never more favorable for an active Electric Vehicle campaign.

Foster Electric Vehicle Garages as Well as Electric Vehicles

Besides pushing the use of Electric Vehicles, it will pay you to see that there are proper garage facilities. Help the garage men along. They will appreciate your assistance—and will help you to popularize the Electric. If necessary, you can profitably conduct a public garage under your Central Station's name. It will have splendid advertising and "good will" value, besides being of immense service to the public.

We are conducting a nation wide campaign of publicity on behalf of the Electric Vehicle — pleasure and commercial. We will gladly show you how this national campaign can be made of immense individual benefit to *your* Central Station. Why not write for particulars ? You surely should do this today.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA

BOSTON *NEW YORK, 124 W. 42nd St.* *CHICAGO* (36)

Protection from Lightning Troubles

(MOSCIKI SYSTEM)

The following list of users of the Mosciki System of Lightning Protection speaks for itself:

- Victoria Falls and Transval Power Co.
- Shanghai Municipality.
- Melbourne Electric Supply Co.
- Cleveland and Durham Power Co.
- St. John Del. Key Co., Brazil.
- Societa Dergano.
- Sociedad Espanola, Madrid.
- Societa Electrica Suburbana, Milan. &c.

Lightning, if unchecked, will break the windings of your apparatus, blow out your fuses and break down your transformers.

In short, lack of adequate and capable lightning protection may mean to you serious loss of time, money, and perhaps lives.

A host of so-called lightning arresters are on the market, but 99 per cent. of them are valueless because the principle on which they are constructed is wrong.

High frequency—not high voltage—is the cause of the damage done by lightning.

Most protective systems work on the principle that high voltage is the cause of the damage. This is incorrect, hence their uselessness.

A lightning protection apparatus to be of any use **must offer a clear path to earth for high frequency currents independent of voltage.**

The MOSCIKI System of Lightning Protection fulfills this condition absolutely—it's principle is correct—its design the best and its guarantee absolute. Write us for fuller particulars.

Mosciki Lightning Arrester

Exclusive Canadian Agents

CHAPMAN & WALKER, ELECTRICAL ENGINEERS AND CONTRACTORS
65-69 Victoria Street, TORONTO

V. I. R. Cables

Wire, Flexible

Paper Insulated Lead Covered Cables

Telephone Cables

MONTREAL AGENTS:
Alexander Macpherson & Son,
Montreal, Que.

.075 sq. in. three core, circular lead covered, steel tape armoured cable

Vulcanized Bitumen Cables

Transmission Lines

Trailing Cables

TORONTO AGENTS:
Chapman & Walker, Limited
69 Victoria Street
Toronto, Ont.

W. T. Henley's Telegraph Works Co.

Limited

Contracts taken for complete Cable Systems installed

Bare and Insulated

WIRES AND CABLES

in

Copper and Aluminum

RAILWAY FEEDER CABLES

in Copper and Aluminum

Copper Trolley Wire
Copper Clad (Duplex Metal) Wire
Galvanized Steel Strand for Guys

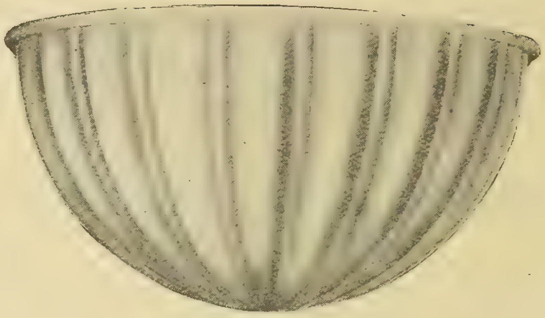
Canada Wire & Cable Co.

Limited
1170 Dundas Street, TORONTO

Stock of Wire and Cable Carried in Toronto, Montreal and Winnipeg

SALES AGENTS:
Roper, Clarke & Co. Limited, MONTREAL
A. E. Esling, Scott Block, WINNIPEG
Macdonald, Marpole Co. Limited, VANCOUVER
Messrs. Gorman, Clancy & Grindley, Ltd., WINNIPEG and EDMONTON

LUCEO



Luceo Hemispheres
8-10-12-14-16 inches

No Glass can be compared to **Luceo** for Artistic and Commercial Lighting. We manufacture many beautiful designs for home lighting—Semi-indirect Bowls now being popular. These are made in various shapes—Colonial, French, Greek and Old English designs.

For Commercial Lighting we recommend **Luceo** Hemispheres and Reflectors. They have a limpid translucency that is effective in true light qualities. They give a maximum of efficiency without glare. They are pleasing in appearance and add harmony to a modern store.

No. 4020—Luceo—40 Watt

No. 4028—Luceo—150 Watt

WRITE FOR BOOKLET

No. 4026—Luceo—100 Watt

The Jefferson Glass Company *Limited*

MADE IN CANADA

TORONTO CANADA

SUNBEAM
MAZDA LAMPS

Light the Way To Profits

The service given by a Sunbeam Mazda Lamp is one that will lead to further business. These lamps have a continuous drawn wire tungsten filament that will stand any reasonable amount of jar and vibration.

Every dealer and central station should carry a complete stock of Sunbeam Mazda Lamps—they mean better light for your customer, which reflects credit to the dealer, and means more business for the central station.

Prompt service is a specialty with us.
May we send you prices and particulars?

The Canadian Sunbeam Lamp Co., Ltd.

Main Office and Factory:
Dufferin and Liberty Streets
Toronto

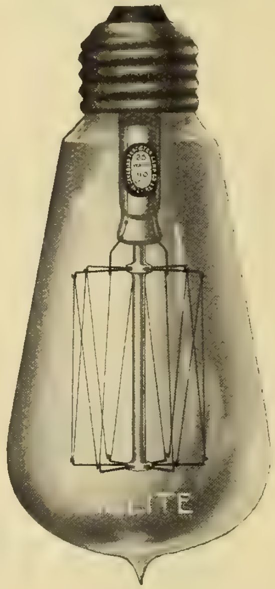
Northwestern Office and Warehouse:
173 McDermott Avenue
Winnipeg

NULITE

Registered

TUNGSTEN LAMP

Everybody's
Doing
It



Doing
What
Why——

Buying **"NULITE"** Tungsten Lamps of course
Because **"THEY"** are the best that can be had
Made in **Canada** by skilled **Canadian** workmen

MANUFACTURED BY

The Canadian Tungsten Lamp Company
Limited

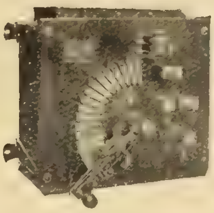
Hamilton -:- Ontario

CUTLER-HAMMER

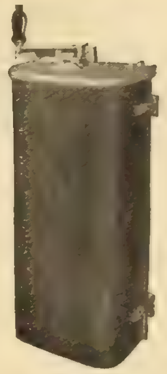
A.C. Starter. Drum Type
Bulletin 9135

A. C. Starter for Slip Ring Motors of Moderate Capacities
Bulletin 9135

6-in Speed Regulator for motors 1/20-1/6 H.P.
Bulletin 8520



D. C. Motor Starter
Bulletin 2110



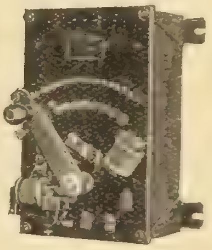
Crane Controller ask for
Bulletin 5300

Dust Proof D. C. Motor Starter
Bulletin 2190

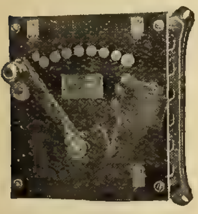
For the Unusual as Well as the Usual Requirements

Because of the thorough working out of each step in the development of the most extensive line of motor controllers on the market, our engineers know what changes or additions are needed to meet the out-of-the-ordinary requirements.

An important part of our business is providing for the unusual as well as the usual cases of motor control. Our specialized engineering force can take care of your motor control problems, no matter how different or difficult they are.



Combined Starting and Regulating Rheostat
Bulletin 2240



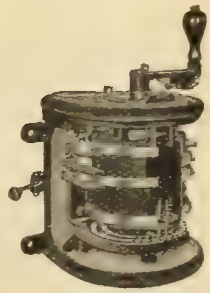
Speed Regulator for Fans, Pumps, etc.
Bulletin 3110

CUTLER-HAMMER MOTOR CONTROLLERS

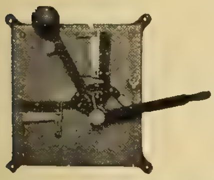
The Standard for Twenty Years

are used in a large majority of the motor installations in the country. They include the little regulators and starters used with the motors driving sewing machines, jewelers' buffers, etc., as well as starters for motors of every type and size—including the largest—and pump controllers, printing press and machine tool controllers, steel mill controllers, besides innumerable styles of automatic starters and controllers.

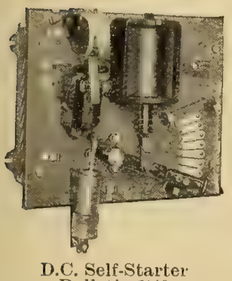
Because of the extensiveness of our line a standard controller will often accomplish what you may think will require special apparatus. If you have an unusual case, give us the particulars. Bulletins on any class of motor control apparatus will be sent you as soon as you ask us to.



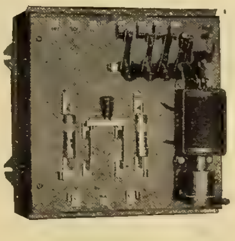
Machine Tool Controller
Bulletin 5220



Float Switch for use with Pumping Equipments and Self-Starters
Bulletin 6775



D.C. Self-Starter
Bulletin 6110



Automatic Motor Starter for Pumps, Vacuum Cleaners, etc.
Bulletin 6100

Gauge Type Pressure Regulator

Bulletin 6760

Polyphase Motor Speed Regulator

Bulletin 9320

D. C. Starter with Knife Switch and Fuses
Bulletin 2150

THE CUTLER-HAMMER MFG. CO. MILWAUKEE

NEW YORK: Hudson Terminal (50 Church Street) CHICAGO: Peoples Gas Bldg. PITTSBURG: Farmers' Bank Building
BOSTON: 176 Federal Street PHILADELPHIA: 1201 Chestnut St. CLEVELAND: Schofield Building
PACIFIC COAST AGENTS: Otis & Squires, 155 New Montgomery Street, SAN FRANCISCO
AGENT FOR SOUTHERN CALIFORNIA: W. B. Palmer, 416 E. 3rd St., LOS ANGELES

Mr. Contractor and Fixture Dealer:

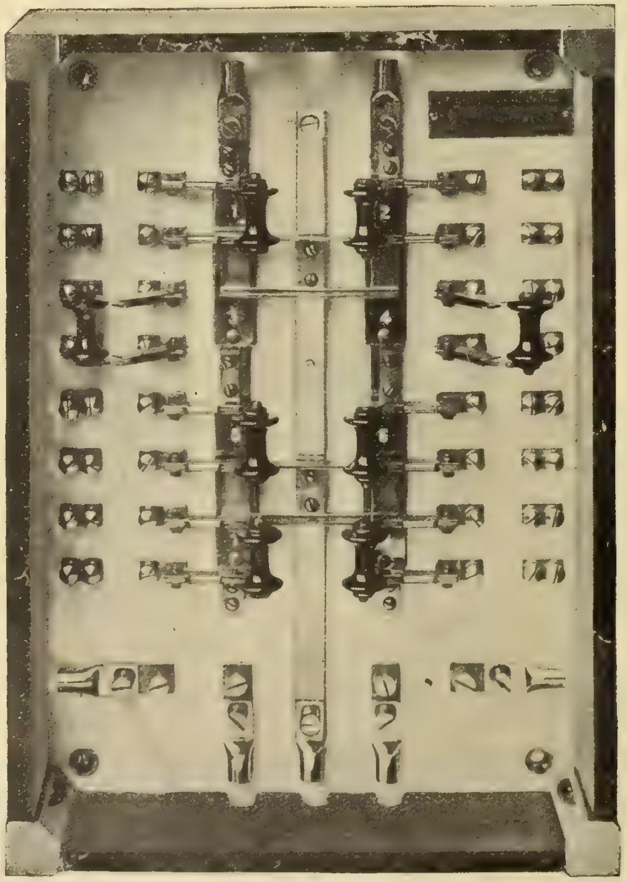
Are you shaping your policy for 1913? You no doubt are anxious to promote greater efficiency and bigger profits for the year.

Time was when fixtures sold the glassware, to-day globes and reflectors influence the sale of fixtures, and have secured many a good order and fixture job for the Contractor and Fixture Dealer.

"Holophane" has always stood for a high standard of efficiency. To-day it has associated with it lines that meet the highest demands for artistic globes and reflectors.

The Holophane Co., Ltd., Toronto, are makers and distributors of the longest and strongest lines of globes and reflectors in the world. "Holophane" (Made in Canada) Iris, Veluria, Calla, Pyro, Cut and Etched, Holophane Steel and Porcelain Enamel Reflectors. Each line distinctive and a leader, one that will help build up your business.

New designs in enclosed and semi-indirect units. See all these new things before deciding on next year's stock. They will help promote sales and indirectly your profits. Wait for the Holophane man.



KRANTZ
Switch Boards
and
Panel Boards

Are the make used in many of the largest institutions, office and government buildings in the United States and Canada.

WHY?

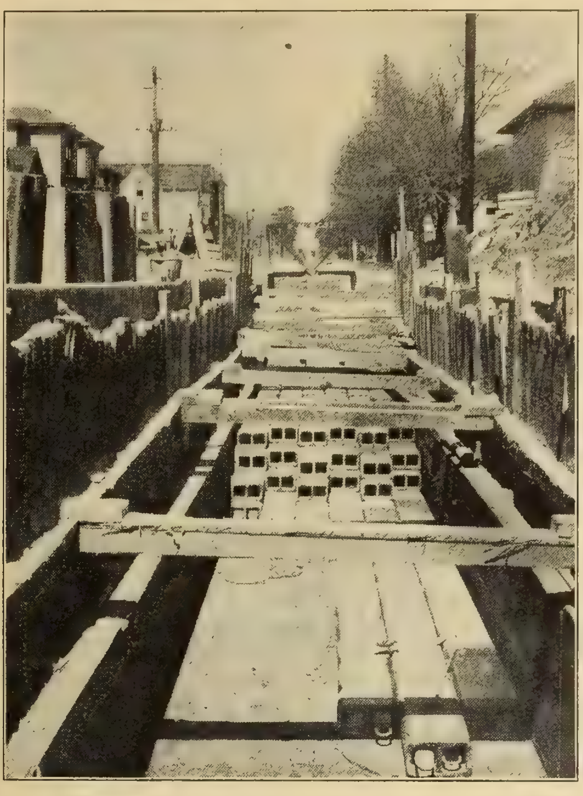
because they are the recognized leaders.

Send us your enquiries.

Canadian Agents
The C. H. L. Keeler Co.
Limited
TORONTO, ONTARIO

G. M. GEST

Conduit Engineer and Contractor



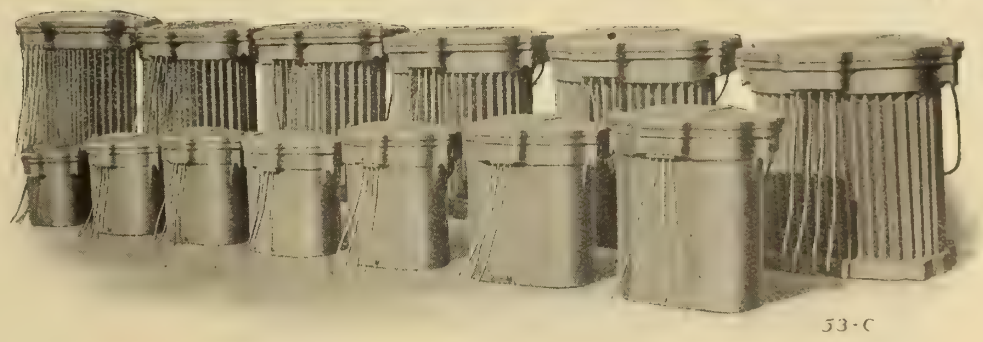
Electrical Underground Conduit Systems

When **G. M. GEST** designs and constructs your Conduit System you receive the benefit of many years' experience and specializing in that line of work.

Power Building, Montreal, P.Q.

Crocker-Wheeler Transformers

A. C.
Induction
Motors
Generators
Transformers



D. C.
Motors
for all
classes
of work
Generators

A full stock of standard voltage distributing transformers in sizes 1 to 50 K.V.A. 60 to 25 cycle is on hand for immediate shipment.

Communicate with us regarding your Fall and Winter requirements.

The Canadian Crocker-Wheeler Co., Ltd.

Manufacturers and Electrical Engineers

Head Office and Works:
ST. CATHARINES, ONT.

Branch Offices:
MONTREAL TORONTO VANCOUVER

BANNER TRADE MARK.

"Banner"

TRADE MARK

BANNER TRADE MARK.

Lighting Fixtures

Write to us for the latest designs in "up-to-date" electric fixtures.

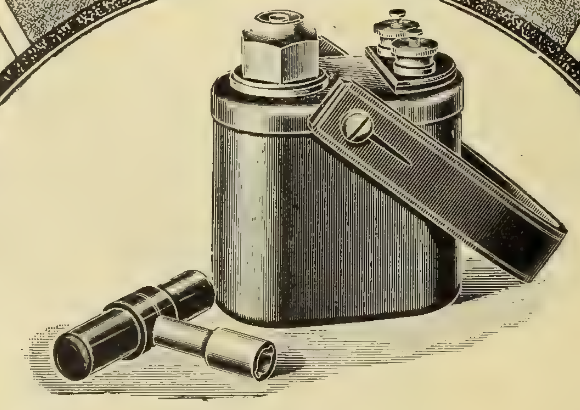
Fixtures made from original drawings on short notice.

Ontario Lantern & Lamp Co., Limited,
HAMILTON, CANADA.

STERLING TELEPHONES

BRITISH MADE

STRONG & RELIABLE



No. C2599

Electric Blasting Machine
to Fire Two Shots
Weight 3½ lbs.

Drawn Brass Case
Detachable Handle
British Made

AGENTS (*with Stock*)

MANITOBA
The James Stuart Elec. Co. Limited
Winnipeg

ONTARIO
Chapman & Walker, Limited
Toronto

SASKATCHEWAN
Northwestern Electric, Ltd.
Regina

BRITISH COLUMBIA
Cope & Sons
527 Dunsmuir Street, Vancouver

ALBERTA
General Supplies, Limited
1233 2nd Street East, Calgary

QUEBEC—*Stocks kept by*
Dawson & Co., Limited - Montreal
Mechanics Supply Co.,
St. Paul, Quebec (Que.)

NOVA SCOTIA -*Stocks kept by*
J. Starr, Son & Co., Limited, Halifax

The Seven Essentials

which must **all** be present in every **successful** installation of indirect illumination.

(1) Most powerful reflectors *made*

to reflect the largest amount of light generated by the lamp against the ceiling, thus attaining the desired brightness in the illumination of the room at a minimum cost for current.

(2) Reflectors of *scientific* design

to direct the light rays against the ceiling at the proper angle so that they will be re-reflected from the ceiling to evenly light the room, and correctly to prevent streaks on the ceiling.

(3) Reflectors of *lasting* brilliancy

so that the illumination does not become dim with the passing of time on account of the reflecting surface deteriorating.

(4) *Scientific* installation to produce known results

The reflectors must be the proper number of inches below the ceiling, the fixtures must be spaced correctly, the bowls must contain the right type of reflector (concentrating or distributing), etc.

(5) *Natural* seeing conditions for the eye to work by

There must be no visible light sources. No sharp shadows. No direct or reflected glare. No blotchy illumination. No light rays striking the eye directly.

(6) *Low* maintenance cost

Washing of the reflectors must be made unnecessary to save time (Labor cost). Handling of the reflectors and lamps must be reduced to a minimum to save breakage. (Equipment cost).

(7) *Variety* and *Harmony* in fixture design

The interior bowl equipment, i.e., the powerful reflectors, the holders to keep them in the right position with relation to the lamp, etc., must be interchangeable and adjustable to special designed fixtures to harmonize with different interiors.

Before we applied science in perfecting X-RAY reflectors, and their appliances, which embody ALL these essentials, satisfactory Indirect Illumination was impossible. Time has not changed this condition!

These powerful X-RAY reflectors and interior bowl equipment are manufactured exclusively by us and used solely with the

EYE COMFORT SYSTEM
of Indirect Illumination

The most complete and best equipped Engineering Department in the country is always at your service.

National X-Ray Reflector Co.

CHICAGO
214 W. Jackson Blvd.

NEW YORK
505 Fifth Ave.

NEWTYPE BERGMANN LAMPS

(Tungsten Filament)

The Unbreakable Kind

Are Now Ready for Delivery

We guarantee delivery to you in good condition

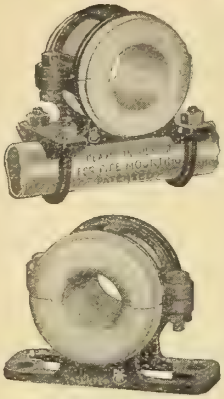
EXCLUSIVE CANADIAN DISTRIBUTORS

P. H. KLEIN CO.,
LIMITED

329 CRAIG STREET WEST
MONTREAL, P.Q.

LIVE AGENTS WANTED ALL OVER CANADA

E E E CO
E E E CO CHICAGO ILL PAT APD FOR NO 54
E. E. E. CO. CHICAGO ILL PAT APD FOR NO 14
E E E CO

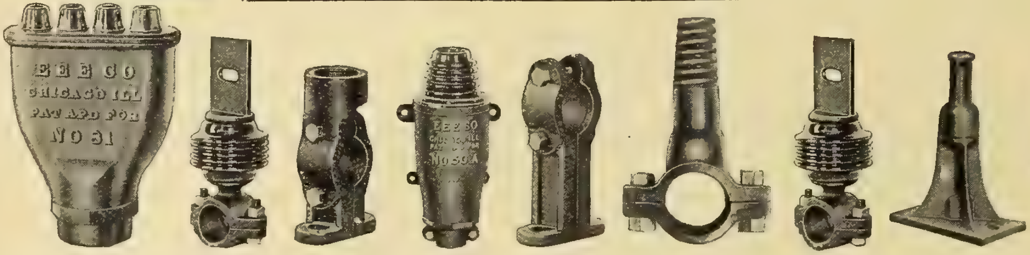


HUNDREDS of distribution problems have taught us the importance of little things—things that even you might be pardoned for overlooking.

That is why you will find it most satisfactory to use our Cable Bells, Potheads and Cable Terminals.

Write for our big blue catalog.

Electrical Engineers Equipment Co.
10-12 N. Desplaines St., Chicago, Ill.



The Devoe Electric Switch Company

Manufacturers of

Panel Boards, Switches, Iron Boxes and Switchboards

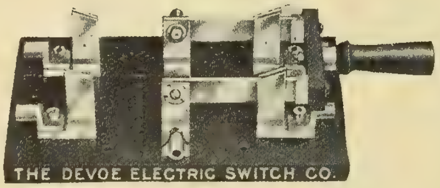
Write for Catalogue

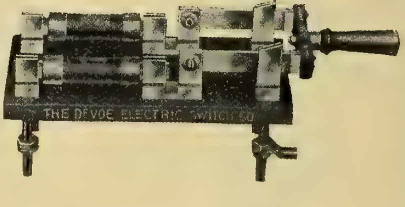
The constant increasing sales of the Devoe Switches is a proof that they are giving satisfaction. If you are not using Devoe Switches begin at once. All our Switches from 25 to 200 amp. are neatly packed in Cardboard Boxes and the others are well parcelled and labelled ready for shipping.

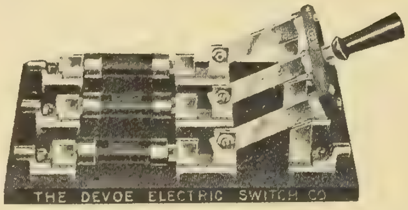
Every "DEVOE" product is built for efficient service under actual operating conditions.

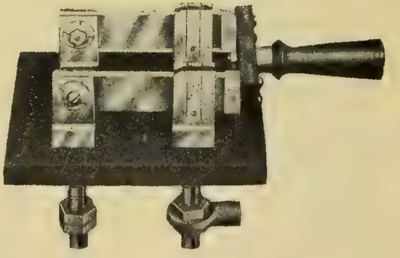
When specifing insist on DEVOE SWITCHES

Office and Factory: 157 Craig St. West, Montreal, Canada

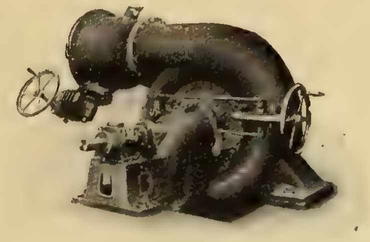








Water Power Plant



Type 30 Francis Turbine
1000 B.H.P. 120 Feet Fall

As supplied to Ocean Falls Pulp and Paper Co., Dryden Timber and Power Co. Expert advice at your immediate disposal for estimating purposes, etc.

James Gordon & Company
81 and 83 Knightrider Street, LONDON, ENGLAND.

Sole Canadian Agents
Chapman & Walker, Ltd.
69 Victoria Street, TORONTO

Longer Life at Lower Cost

For Satisfying Results in Underground Subway and Power House Construction specify American Bitumized Fiber Conduit. Strongest and most durable conduit made.

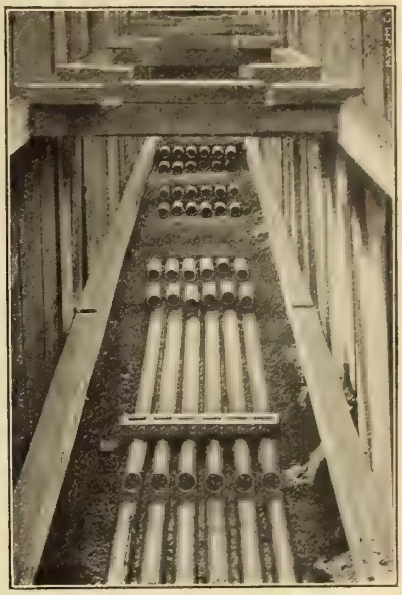
Electrolysis proof—water-proof—gas proof

Write for Booklet and General Information

American Conduit Co.
140 Nassau St., New York - East Chicago, Indiana

J-M Fibre Conduit

"The Conduit You'll Eventually Use"



For Underground Systems of Distribution affords great economy in
- Installation
- Freight
- Excavation
- Handling
- Carting
- Laying, etc.

Being a non-conductor it is proof against electrolysis, and reduces cable troubles to a minimum. It is also water and acid-proof.

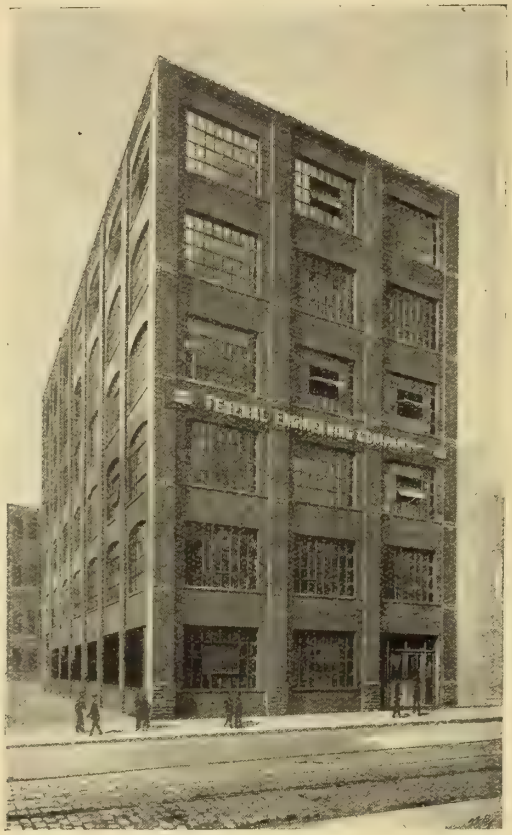
J-M Fibre Conduit is furnished with Bell or Straight Joints in four styles: Socket, Drive, Sleeve and Screw, together with fittings and bends to meet all conditions of service. Standard tube lengths 2 in. to 4 in. in diameter Bell Joint, 54 in. and Straight Joint 60 in. long.

Write our nearest Branch for booklet and prices.

The Canadian H. W. Johns-Manville Co. Limited

ASBESTOS
Manufacturers of
Asbestos and Magnesia Products, Asbestos Roofings, Packings Electrical Supplies, Etc.

TORONTO MONTREAL
WINNIPEG VANCOUVER
1511



Announcement

THE Federal Engineering Company, Limited has been formed for the purpose of enlarging the scope of, and carrying on the business heretofore carried on by the Federal Engineering and Supplies Limited.

The new Company also takes over the R. T. MacKeen Company of Montreal, and other concerns.

Our business has grown to such an extent that it has been necessary to increase our capital, and secure larger office and warehouse accomodation.

We have therefore moved our Toronto office and warehouse to a large new warehouse building at 90 Sherbourne Street, Toronto, and our Montreal office and warehouse to the Unity Building, Montreal.

It is proposed to carry a full line of all kinds of Belting, Mill Supplies, Tungsten and Carbon Lamps, Automobile Supplies, Automobile Lighting Outfits, Electric Meters, Electric Fans, Electric Motors, Electric Irons, Heating Devices, Supplies, etc., etc.

We wish to thank our friends and customers for their very generous patronage in the past and to assure them that the aim of the new Company will be to so serve them as to merit a continuance of their confidence in the future.

We are in a position to make prompt deliveries, and attractive propositions. Be sure and get our prices before placing your order.

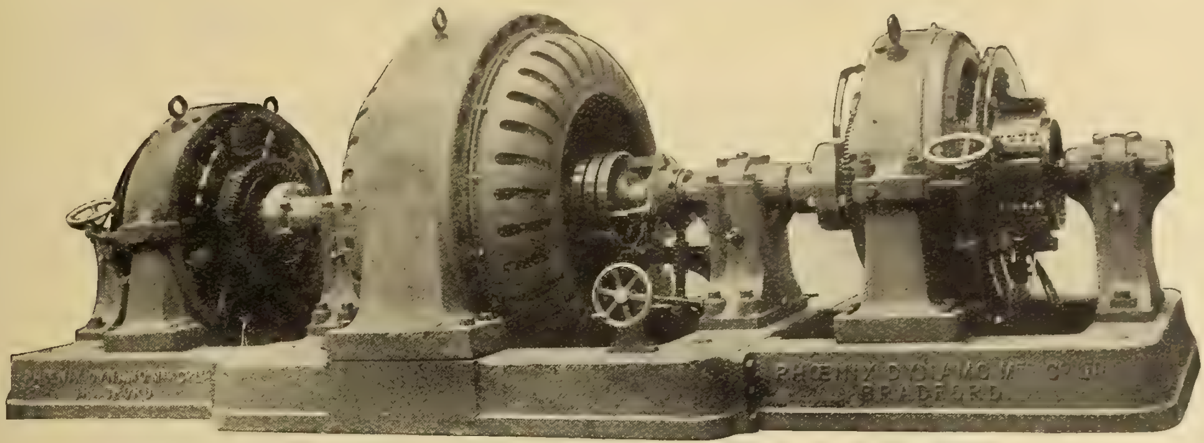
FEDERAL ENGINEERIN

MONTREAL **TORONTO**

Phoenix Dynamo Mfg. Co.

Limited

BRADFORD, ENGLAND



300 K.W. 230 to 280 V. D.C. per side, and driven from 6600 V. 60 Cycle 3-phase Induction Motor

Canadian Agents:—FEDERAL ENGINEERING CO., LTD., MONTREAL, TORONTO, WINNIPEG, VANCOUVER

FEDRAM TUNGSTEN LAMPS

and

FEDERAL CARBON LAMPS

will Save Money for you.

Full particulars on application

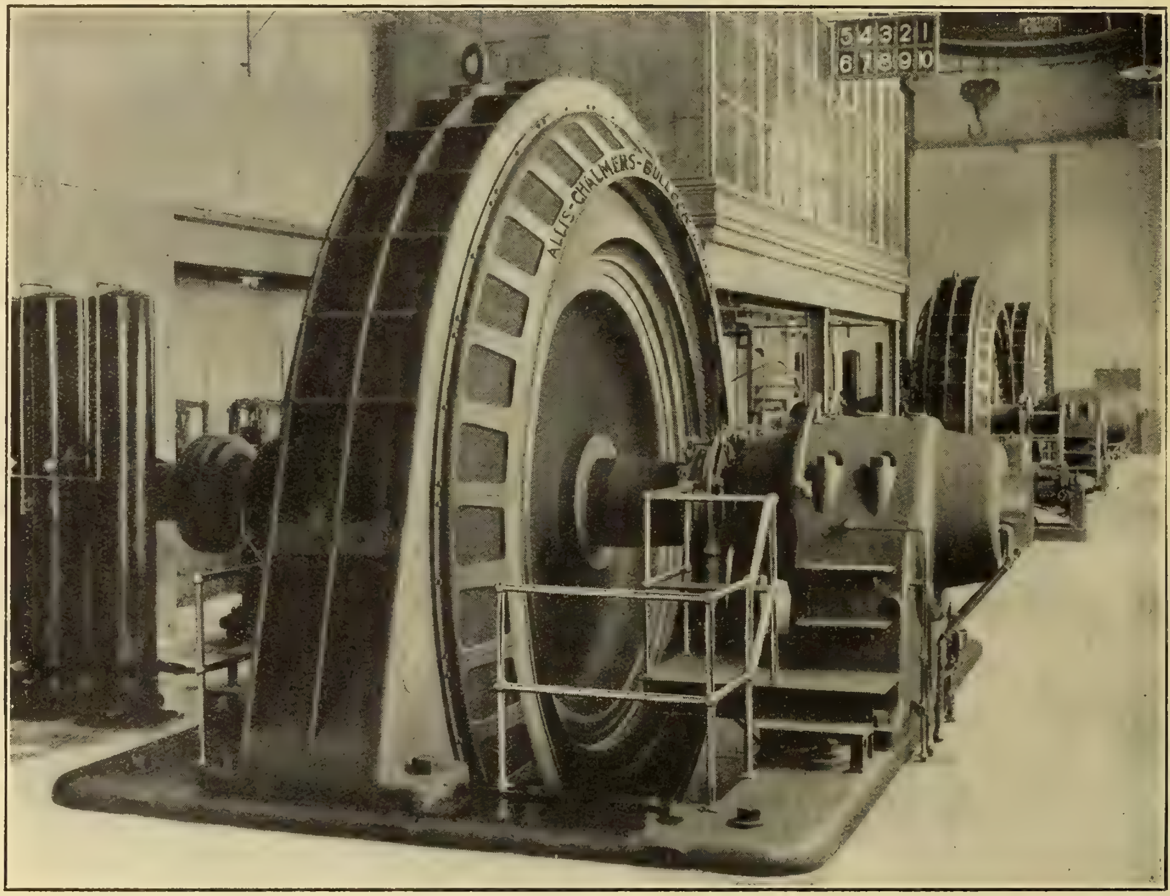
COMPANY, LIMITED

WINNIPEG VANCOUVER

Water Wheel

Type of

Alternating Current Generators



3 Alternators each 5,000 K.V.A. 60 Cycle, 3 Phase

in the St. Timothee Power House of

The Canadian Light and Power Co.

built by

ALLIS-CHALMERS-BULLOCK
LIMITED

WORKS - - - MONTREAL

Sales Offices: MONTREAL, Canadian Express Co. Bldg.
WINNIPEG Builders Exchange Bldg.
COBALT
TORONTO, Traders Bank Bldg.
VANCOUVER, Dominion Bldg.
CALGARY

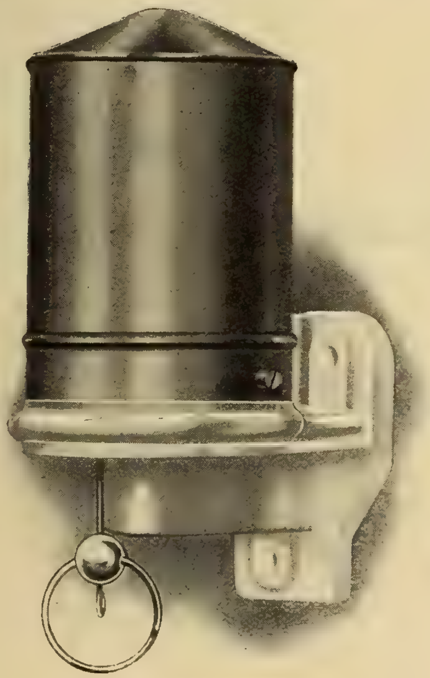
REDUCE ACCIDENT RISKS

National Railroad Trolley Guard installed at steam road grade crossings, minimizes chances of cars being stalled should trolley wheel leave wire.

Easily installed, light in weight and requires little maintenance.

See pages 174-176 of Catalogue No. 12

The Ohio Brass Co., Mansfield, Ohio, U. S. A.



FLAT RATE CONTROLLER

Satisfies Your Customer

Reduces Operating Costs

Eliminates Meter Disputes

Smallest, Lightest and Most Durable on the Market

Write for illustrated pamphlet and prices.

Made in All Capacities up to 5 Amperes

The Only Reliable Controller for Tungsten Lamps

The Gorla Current Limiter
3 Beaver Hall Square, MONTREAL

The Lachute Shuttle Co., Limited
Lachute Mills—P.Q.

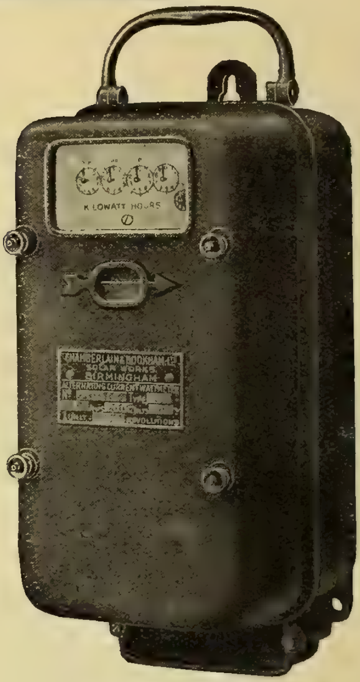
Manufacturers of

Cross Arms—Space Blocks—Birch and other Hardwood Insulator Pins and Brackets.

— C. & H. METERS —

Our meter brings you in more dollars, WHY ? Because it starts on a smaller current and is more accurate over long periods than any other on the market today.

Write to us *now* and we will tell you why this is so, and what is more, prove it with goods.



Polyphase Meter

The
Chamberlain & Hookham Meter Co.
Limited

312 Kent Building, TORONTO

Meter and Time Switch Specialists

Main 7791

Cables "Meters"

The New Year is the Season for New Contracts

For some lines of goods it pays to contract, especially when you are protected against a raise in price and given the advantage of a reduction. We have special contracts, which we are sending out to our customers, covering :—

NEW CODE RUBBER COVERED WIRES AND CABLES
MAZDA TUNGSTEN AND CARBON LAMPS
COLUMBIA DRY CELLS
GALVANIZED AND ENAMELLED STEEL CONDUITS

We maintain in Winnipeg heavy stocks of the above materials ready to ship to you the day your order is received. Our price is in line with the lowest market quotation. We give you the advantage of car load rates from factory to Winnipeg.

Write for copy of our special yearly contracts, and if you mention seeing this advertisement in the "Electrical News," we will send you one of our 1913 calendars.

The Mainer Electric Company, Limited

61-63 Albert Street, WINNIPEG, MANITOBA

"H-C" Light Weight Telephone Testing Sets

Size 5"x 5"x 5 1/2
Weight 6 1/2 lbs.

Equipped with 5-foot cords and Williams test clips. Carefully designed, durable and efficient. Crank folds flush with the case.

SEND FOR NEW BULLETIN 402

THE HOLTZER-CABOT ELEC. CO.
Chicago, Ill.—Brookline, Mass.

Holtzer-Cabot

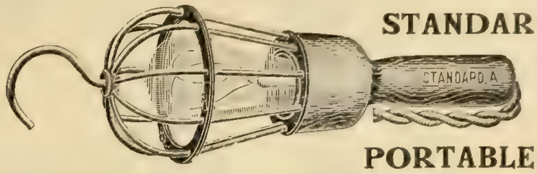
McGill Portable Lamp Guards

enable lighted incandescent lamps to be safely carried to dark corners within reasonable distance of a lamp socket.

Convenient Economical Safe

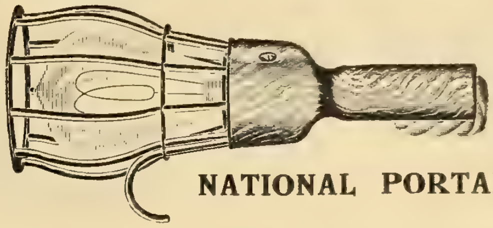
Thousands in daily use in Mills, Factories, Warehouses, Garages, etc.

STANDARD



PORTABLE

A substantial, serviceable portable, which has been a popular seller for years; always dependable. For 16 and 32 C. P.



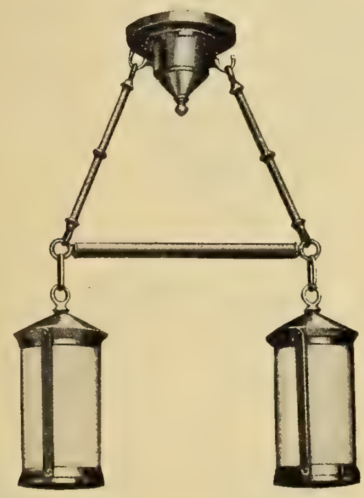
NATIONAL PORTABLE

Here is the best medium priced portable ever offered. Well made, very strong and will stand hard knocks and give long service. For 16 and 32 C. P.

Write for net prices on these portables; also for New 1913 Catalog showing other portables, Lamp Guards and Electrical Specialties

McGill Guards and Specialties carried by most Canadian Dealers

McGILL MFG. CO.
5 Oak Street — VALPARAISO, IND.



Fixtures that are Different

Showing the Latest Designs

Fixtures that are Right

For Every Requirement

A Tungstolier for every Purpose

Direct - Semi-Indirect - Showers - Brackets - Lanterns, etc.

Catalogue No. 100a Shows Them All

DID YOU GET YOUR COPY? IF NOT WRITE US

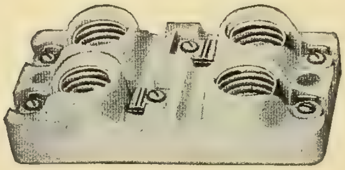
The Tungstolier Company
of Canada, Limited
HEAD OFFICE: **212 King St. West, TORONTO**

DUNCAN

Edison Plug Cutouts and Entrance Switches

of

Duncan Quality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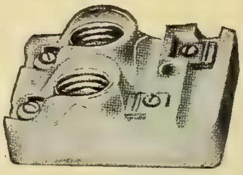
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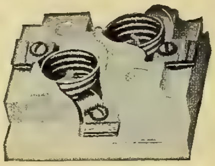
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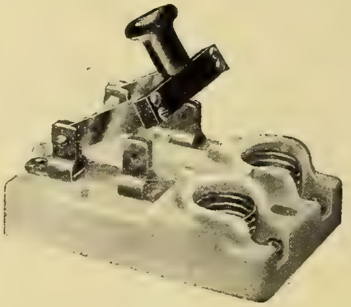
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The Duncan Electrical Co.
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Montreal

Makers of Electrical
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White's Improved
Porcelain Strain Insulator

Try this New and Better
STRAIN INSULATOR

Made in Four Sizes. Write for Illustrated Bulletin.

Will furnish Sample if desired.

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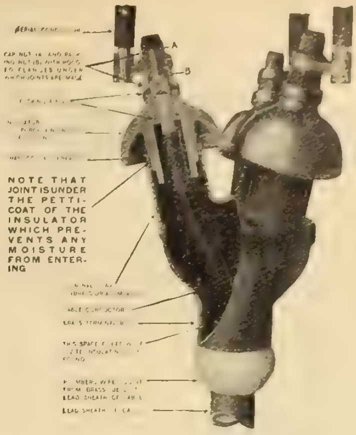
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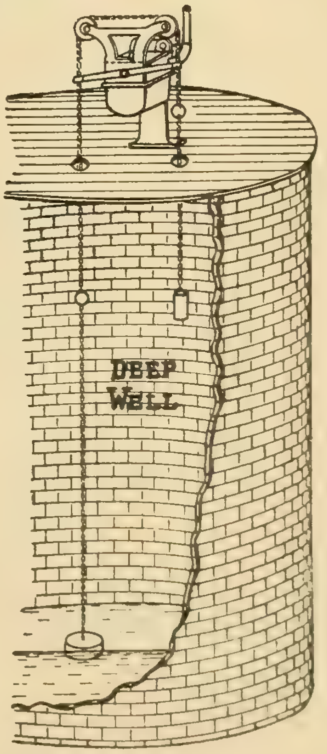

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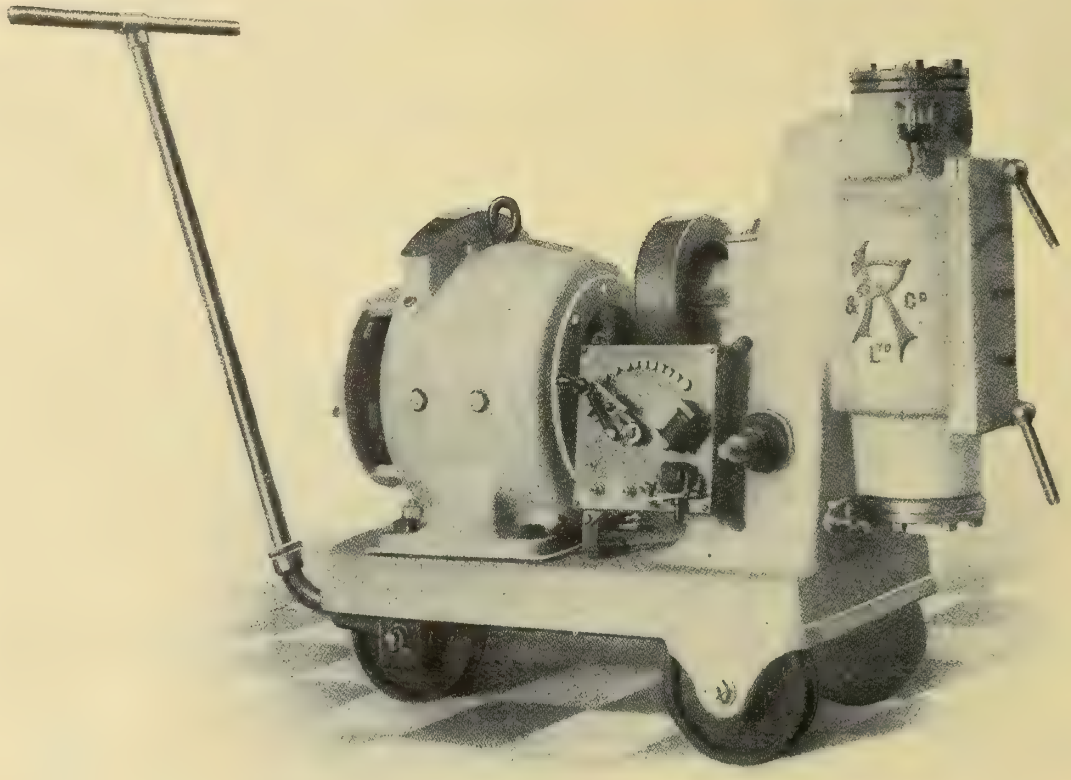

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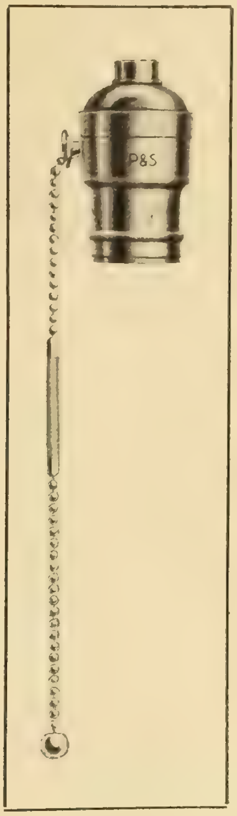

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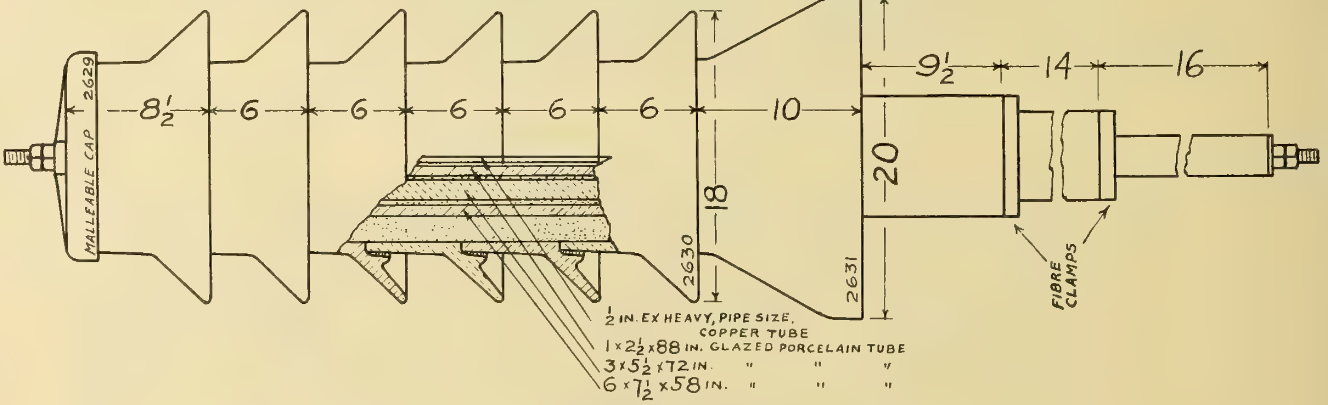

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Electrical News
Generation, Transmission and Application of Electricity

PUBLISHED SEMI-MONTHLY BY
HUGH C. MacLEAN, LIMITED,
HUGH C. MacLEAN, Winnipeg, President.
THOMAS S. YOUNG, General Manager.

HEAD OFFICE - - 220 King Street West, TORONTO
Telephone Main 2362

MONTREAL - Telephone Main 2299 - 119 Board of Trade
WINNIPEG - Telephone Garry 856 - 404 Travellers' Bldg.
VANCOUVER - Tel. Seymour 2013 - Hutchison Block
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Vol. 22 **Toronto, February 1, 1913** **No. 3**

Underwriters' Requirements

On another page in this issue we print a report recently made by Mr. C. Hamilton Wickes to the British Board of Trade on the formation, scope of operations and effect on the importation of British manufactures into Canada, of the Underwriters' Laboratories, Chicago. The report covers fully the history of the formation of this incorporation; describes the technical staff, the council and their respective work; outlines specifications, rules and requirements under which the experimental work is carried on at the laboratories; speaks of the inspection at manufacturers' factories and labelling; roughly outlines the cost of experiments and tests incurred by manufacturers who desire to have their material approved, etc., etc. Inasmuch as this is a matter of interest to every Canadian buying or selling electrical equipment, many of whom we believe are not aware of the existent conditions, we print this part of the article in full, believing that it contains much useful information.

However, the part of the report which is of greatest interest to Canadians is that which deals with the effect of the operations of the Underwriters' Laboratories on the British manufacturer. It has long been recognized in a general way that British manufacturers were more or less inconvenienced by having to conform to the rules and requirements laid down by the National Board of Fire Underwriters, but in the report in question, some statements are made which appear to require further investigation. For example, in one place it is stated that complaints have been made by British manufacturers of prejudice on the part of inspectors against British goods and of the necessity of gaining the inspectors' good-will by means of a "tip" in order to facilitate the passing of material submitted. In another case it is stated that particulars are on file, of instances in which the parties interested alleged discrimination and unfair treatment in respect of both electrical and other classes of goods submitted to the laboratories. If such complaints as the above can be substantiated, it is quite time steps were taken to show up the workings of the Underwriters' Laboratories in their true light. Of course, it is easily understood that these are matters difficult of proof. There is no doubt, however, that the feeling exists that discriminations have been shown, and under the circumstances it is not difficult to impute motives. On the other hand, we are decidedly of the opinion that the work of the Underwriters' Laboratories has, in the main, tended to improve conditions and has gone far towards making the installation of undesirable equipment impossible

* * *

A phase of the question that is no doubt felt keenly by the British manufacturer, and this applies to Canadians as well, is the fact that a British manufacturer who has been manufacturing standard equipment for many decades and whose products are known and recognized as standard the world over, should have to submit his apparatus to the inspection of a United States authority before this apparatus can be sold in a part of the British Empire—Canada. Then there is the other reasonable contention that inasmuch as the inspectors are specially equipped to pass on the United States type of material they are not in a position to give an immediate and final judgment on the efficiency of a British manufactured article. Further, it may easily happen that though the British article may be entirely up to any general standard that may be set, it may fail to meet the requirements of the particular standard of the Chicago Laboratories and so may fail of approval.

* * *

A suggested solution is the formation of a testing and approving laboratory in England or Canada along lines very similar to that in the United States. It does seem unreasonable that a nation as widely represented by territory as Britain is should not have a standard of her own which would be accepted without question, in any colony of the Empire, or for that matter in any other country. There can be no doubt that the British manufactured article reaches as high a standard as anything manufactured in the world to-day, and the whole trouble evidently arises from the fact that in the United States they have taken the initiative in this matter while the Englishman did not feel the need of the same progressive step until he came in direct contact with the United States product on this continent. The British manufacturer at the present time is trying hard to win his way into the North American, and especially the Canadian field, and every Canadian is anxious to assist him in every possible way to gain a foot-hold, feeling that by so doing, we shall gain the advantage of the competition of apparatus that it will be to our interests to purchase. We therefore, as Canadians, have put ourselves about to no small extent in encouraging the British manufacturer to tender for the supply of our equipment. It would now seem to be a great mistake if all this progress should have to be set aside, or should even be retarded by what is little more than a technicality. It is quite possible there are British manufacturers who have abandoned the idea of entering the Canadian field rather than submit their equipment to the tests now required. The formation of a British standard, recognized the world over, should mean nothing more than the organization of a department along these lines similar to that of the Underwriters' Laboratories of Chicago. Where it is situated is a matter to no moment so long as it is at the most convenient point for all concerned.

The New Hydro Chief

"School" men will be pleased to note that one of their number has been called to the high office of chief engineer of the Hydro-electric Power Commission of Ontario, in the person of Mr. F. A. Gaby, who graduated, with honors, in the Faculty of Applied Science of the University of Toronto in 1903. Though only a recent graduate, Mr. Gaby has, however, crowded an unusual amount of hard work and experience into a short space of time, having spent a number of years with the C. G. E. company as erecting and supervising engineer, and later with the city of Winnipeg, where he acted as assistant electrical engineer in the preparation of the designs and specifications of their large municipal plant.

Mr. Gaby has been with the Hydro since 1907, practically since its inception. In 1908 he was appointed chief assistant engineer which position he held until Mr. Sothman's resignation in July, 1912. As chief assistant, Mr. Gaby had, of course, been closely in touch with all the engineering features of the Hydro scheme, and so both by ability and experience was particularly well fitted to take up the work of directing the Commission's extensions, which probably at the present moment cover a larger field than at any previous time in the history of this provincial municipal movement. His appointment as acting chief engineer in July, was, therefore, fully expected, and the confirmation of his appointment, in December, as chief engineer, will meet with universal approval.

Mr. F. A. Gaby

Mr. Gaby is almost a Toronto boy, having been born in Richmond Hill, some thirty miles out of the city. He is an associate of both the I. E. E. and A. I. E. E., and is at present chairman of the Toronto section of the latter.

Toronto Section A. I. E. E.

The third regular monthly meeting of the Toronto section of the American Institute of Electrical Engineers was held in the Engineers' Club rooms Friday evening, January 17th. The speakers of the evening were Mr. W. R. Sweany, general manager, the Toronto Hydro-electric System, and Mr. J. G. Jackson, electrical engineer. Mr. Sweany described the advances that had been made in the production of an economic up-to-date street lighting system, comparing the Toronto system with that of a number of other cities. Mr. Jackson dealt more with the engineering side of the system, describing the distribution, location of sub-stations and sub-station design, etc. Mr. Jackson also outlined plans of extensive expansions which the city would likely follow as the demand for power and light increased.

Merger of Power Companies at Cobalt

The Northern Ontario Light and Power Company, Limited, has formally taken over the entire property and assets of the British Canadian Power Company, Limited. The property has been paid for by $2,000,000 first mortgage 6 per cent. Bonds of the Northern Ontario Light and Power Company, Limited, which are due on April 1st, 1931. This is a part of an authorized issue of $15,000,000.

The Bonds, it is understood, have been underwritten by Coates, Son and Company and the British Electric Traction Company, both of London, England, and Hanson Bros., of Montreal. At a near date the issue will be offered for public subscription, probably at par.

It is calculated that the earnings of the Northern Ontario Light and Power Company, will be greatly benefited by the acquisition.

The Northern Ontario Light and Power Company was organized in February, 1911, for the purpose of taking over the properties of the Cobalt Hydraulic Power Company and the Cobalt Power Company, with its subsidiary companies. It has also acquired the Cobalt Light Power and Water Company, Limited.

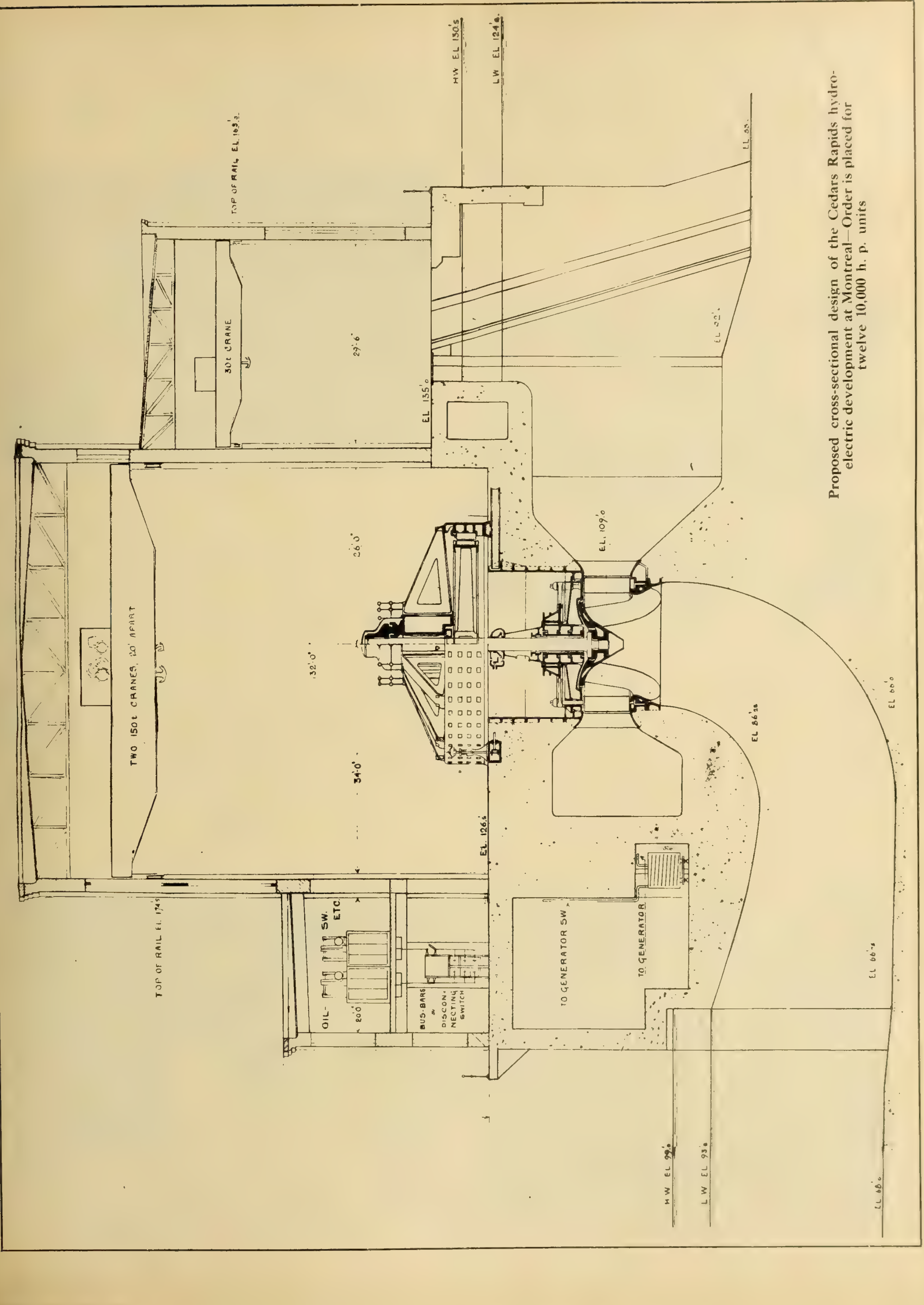
The British Canadian Power Company have a 10,000 horse-power hydro-electric development on the Matabitchonan River, 25 miles south of Cobalt with an electrical sub-station at South Lorrain and two modern sub-stations in the Cobalt camp, each equipped with step down transformer outfits and 2,000 horse-power air compressor plants. Compressed air at 100 lbs. pressure is furnished from these stations, through steel pipes, to the different mines. Electrical power is furnished from the three sub-stations to the mines in the form of a 60 cycle, 2,200 volt, 3-phase current.

The "Cedars" Development Plans

On the opposite page we reproduce the plan of the development of the Cedars Rapids Manufacturing & Power Company at Montreal. This represents the largest single installation, we believe, ever contracted for at one time in Canada, and with the exception of the plant at present under construction at Keokuk on the Mississippi River, probably the largest in the world. Orders have been placed for the manufacture of twelve turbine units, and within the last few days the contract has been closed with the Canadian General Electric Company for the supply of the twelve generators to be connected thereto.

The size of the equipment can be gathered roughly from the illustration. The overall diameter of the generators is approximately 36 feet. The capacity of each is 10,000 kilowatts. The generators, on account of the comparatively low head of 30 feet will revolve slowly, at 56 revolutions per minute.

It will be noticed from the design that the thrust-bearing carrying the weight of the generator-rotor, the shaft and the turbine, is situated above the generator and enclosed in the same case with the generator.

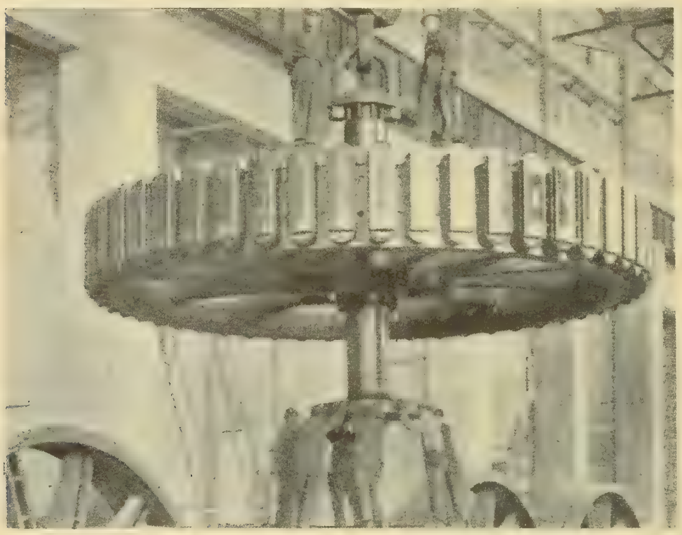


Proposed cross-sectional design of the Cedars Rapids hydro-electric development at Montreal—Order is placed for twelve 10,000 h. p. units

Further Notes on Keokuk Plant

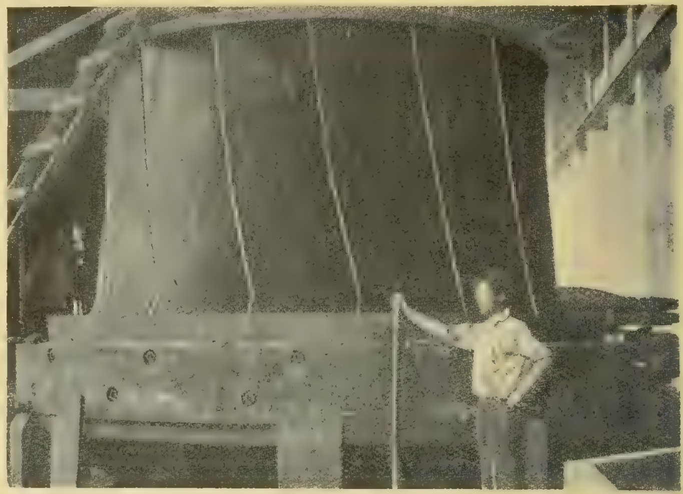
The September issue of the Electrical News contained a somewhat detailed illustrated description of the preliminary work of the Mississippi River Power Company's development at Keokuk, Iowa. It will be remembered that the main plan of this development consisted in the construction of a dam 4,500 feet long, across the Mississippi River and comprising some 120 arches; a power house to contain thirty 10,000-h.p. turbine units; an ice fender some 1,750 feet long for the protection of the intake canals and a huge cement lock and dry dock for the accommodation of river traffic.

The previous description brought the construction up to June 1, 1912. Since that date the dam has been completed and the up-stream end of the power house is also practically finished with, at the last report, three units almost installed. Some more photographs shown herewith illustrate the more advanced stage of the work. One of the figures illustrates the process of setting the lower foundation ring for one of the water wheel units. Another shows a view taken some two months later, being an interior view of the intake for turbine No. 2.



Generator-rotor assembled—Mississippi River.

It will be recalled from the earlier description that pittliners of unusual size were to be embedded in the concrete of the substructure and that these were to carry the weight of the rotating parts of the turbine and generator, a total of about 1,000,000 lbs. of metal. Before placing the turbine, these were tested out by a load of approximately 1,000,000 lbs., made up of huge cement blocks, to see if there would be any settling. This was necessary as the shaft of the turbine would be thrown out of line if any settling occurred after the machinery was installed.

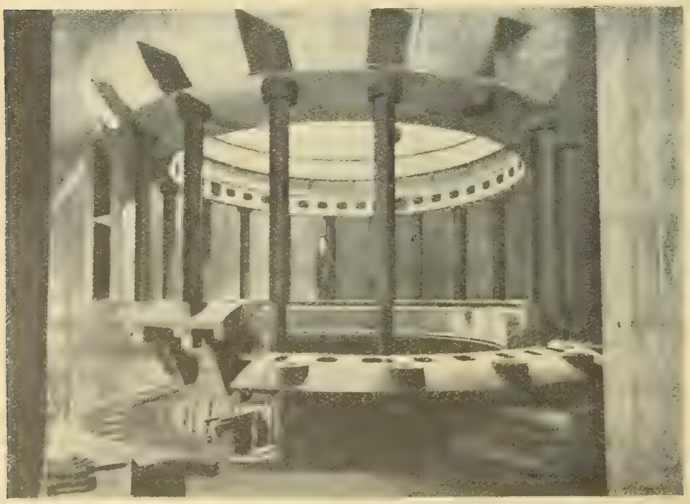


Turbine runner, assembled—Mississippi River.

The shipping and installation of the turbines has required the greatest care on account of their weight and size. The contract for the manufacture of the turbines was divided between two firms. One firm casts the runner in four quarters which are shipped separately. The other manufacturer casts the runner in one piece. The difficulty of such a process will be understood when it is remembered that the complete runner is 16½ feet in diameter by 12 feet high and weighs about 65 tons. To transport this piece it was necessary to build a special car with a capacity of 150,000 lbs., and with a body so designed that the runner could lie on its side. A special route had also to be picked out in which the bridges were high and wide enough to clear this load. Each unit is accompanied by a representative of the manufacturing company, and is allowed to travel only during the day time, every care being taken to eliminate the possibility of accidents.

The Generators

It will also be remembered that each generator when complete, will measure 31 ft. 5 in. in diameter by 11 ft. 3 in. high and weigh approximately 615,000 lbs. The base and



Setting lower foundation ring for turbine unit.

Interior view of turbine intake, completed.

the outside ring or stator are shipped in four pieces and the rotor in two. The windings of each part are shipped separately. For the stator these windings consist of rectangular coils of copper wire which fit into slots cut in the metal of the stator. These are insulated with mica and with oiled tape to resist the high voltage generated in them.

In setting up the rotor the shaft is first set on end on a specially prepared concrete platform; next the two halves of the stator, supported at the proper height by concrete pillars, are bolted around it, and then 52 laminated iron poles with their copper windings are bolted on. At last reports, five of the stators have been wound, four of the rotors assembled, four bases are in place and one has its sections mounted on it.

Work is also proceeding with the installation of the transformers which will step up from the generating voltage of 11,000 to the transmission voltage of 110,000. Each transformer measures 8 ft. x 16 ft. x 24 ft. high and weighs approximately 246,000 lbs. The latest report was to the effect that the conduit work for conducting the lead wires was nearly all in place and that the superstructure should be practically completed by the first of the year.

Our Maritime Provinces

The Canadian Pacific Railway Company have equipped their terminal sheds at West St. John with four 2-ton electric trucks.

Mr. Robt. Bell, of Montreal, has recently been appointed general manager of the Maritime Coal, Railway & Power Company. This company operates a power plant at Chignecto, N.S., supplying light and power for the towns of Amherst, Joggins, Maccan and River Herbert. Mr. Bell was previously manager of the Port Hood Coal Company.

Mr. Thos. Coleman, until recently with Chapman & Walker, Toronto, has been appointed superintendent of the Charlottetown Light & Power Company of Prince Edward Island. This company are at present operating their plant with both steam and gas producer engines, the electrical equipment being single phase, 133 cycles. This year, however, they plan on remodelling the entire outfit and operating a day system, supplying power for the different town industries.

The Intercolonial Railway are planning on installing a system of train despatching by telephone; the first section to be installed will be between St. John and Moncton. The Intercolonial Railway are now using the Moncton Natural Gas very extensively at their shops in Moncton. At the present this gas is being used under their boilers and in the forges, and for lighting cars. Changes are also being made in their producer gas engines which drive the electric generators so that they too may be operated by natural gas.

The new power plant of the Bathurst Electric Light Company was put in operation January 1st and the town is now supplied with a first-class lighting system. The power house is situated at the Letagouche Falls, some nine miles from Bathurst, the transmission line at present being single phase at 6600 volts. A concrete dam 30 feet high has been constructed above the falls which, together with the natural falls, gives a head of seventy feet at the water wheel. The present capacity of the plant is 200 kw. but provision has been made for another unit of the same size. The complete plant was built under the supervision of P. J. Leger, of Bathurst

The Dominion Coal Company have recently put in operation their new power house at Lingan Lake, Nova Scotia. Only one unit is at present in operation; this is a 2,000 kw. Curtis high pressure steam turbine set, the generator being 3-phase, 25-cycle, 6,600 volt and arranged to work in parallel with the company's other power plant at Glace Bay, which is located about nine miles distant. Contracts have been entered into with Fraser Chalmers for two more units of the same size. Bettington boilers are used at this plant; these use pulverized coal, which is fed with a blower. The power house is so arranged that a total of 10,000 horse power in turbines may be installed at a later date.

The new canning factories of the Canadian Sardine Co. at St. Andrews, N.B., began operation January 1. This is a most modern installation, every part of the process, from hoisting the fish from the boats to sealing the cans, being performed with electric motors. Besides canning sardines, baked beans, brown bread, fish cakes, and in fact all kinds of fish goods, will be prepared and canned on the premises. Some idea of the size of the plant may be gained from the fact that some 35 motors of various sizes from 1 to 25 h.p. are in use. A large box and shook factory is also being built; this will be operated with four 25 h.p. motors, the machines being group driven. About one thousand lamps are needed for the lighting of the various buildings. These include a moving picture theatre and dance hall for the amusement of the company's employees who number at present about 800. The complete electrical and steam equipment was installed under the supervision of Mr. R. Kirwin, mechanical superintendent of the Sardine Company's plants.

Montreal a Centre of Activity

Members of the Electrical Association of the Province of Quebec held their annual dinner at Cooper's Restaurant, Montreal, on January 16th. The dining arrangements were excellent, the provision of a number of small tables allowing of the making up of congenial parties. Mr. Clarence Thomson presided, and among those present were: Ald. Boyd, Major Allan (of Verdun), Messrs. M. Rubenstein, J. Bennett, L. Rosseau, E. W. Sayer, R. L. Calder, S. W. Smith (of Engineering Equipment & Supply Company), K. B. Thornton (Canadian Light & Power Company), C. A. Howe (Holophane Company), R. J. Hiller, J. Garth, W. J. Doherty (Northern Electric & Manufacturing Company), A. Hall, N. Simoneau, F. J. Parsons, J. D. Lachapelle, W. N. Dietrich, Fred Thomson, and W. B. Shaw (Montreal Electric Company).

During the evening two presentations were made to Mr James Bennett, who is retiring from the position of chief inspector of the electrical department of the Canadian Fire Underwriters' Association. The first was of a humorous character, being in the form of a stand made of insulating material, with high tension insulators as shelves, which were filled with vegetables. This was presented by Messrs. Rubenstein and Shaw, the former making some remarks in character with the presentation. The other presentation was of a clock and two cut glass decanters, Mr. Shaw making the presentation on behalf of the association. Mr. Bennett replied very briefly.

Letters of regret were read from a number of those unable to be present, including one from Mr. Geo. C. Knott, of the Benjamin Electric, Toronto.

Replying to the toast of "Our Cities and Province," Alderman Boyd, who represented the mayor, spoke of the natural and mineral resources of the province, and of the expansion of Montreal, making reference to the proposed new building by-laws in which electricians were naturally interested.

Mr. C. E. McGregor proposed "Our Guests," to which Mr. Sayer, as representative of the Builders' Exchange, responded. He expressed a hope that the association would see its way to again become affiliated with the Exchange. Mr. Louis Burns, of Quebec, also replied.

"Manufacturers and Jobbers" was proposed by Mr. R. J. Hiller, and responded to by Mr. Doherty, who laid emphasis on the importance of manufacturers and jobbers sticking to their prices, and not cutting rates.

In proposing "Our Association," Mr. R. L. Calder referred to the enormous possibilities of electrical development in the Province of Quebec; the province should, he believed, be the centre of the electrical development of the world, as it could develop more power than all the rest of the world. A great many of our natural resources were being exploited by foreigners, but he had no doubt that the electrical industry would be controlled by Canadians and the people of Quebec. Mr. Sayer replied, and spoke of the success of the weekly luncheons and the mutual benefit which resulted from them.

Mr. Bennett, referring to his retirement, assured the members that, in issuing defect notices and criticising the work of contractors, he had tried to act impartially, and that no personal feelings had entered into his work. Mr. Fred Thomson declared that Mr. Bennett had filled a very difficult position exceedingly well, and had acted without bias to any contractors. Mr. C. M. Tait, as the successor of Mr. Bennett, also briefly spoke on inspection work.

Montreal Tramways Company

The Montreal Tramways Company have taken exception to the jurisdiction of the Quebec Public Utilities Commission in relation to an inquiry proposed to be made into the affairs of the company. The Commission asked for information as to various operations, chiefly in connection with accommodation, routes, lines, etc,. and as this was not forthcoming the company were asked to show cause for failure to comply with the orders of the Commission. At the sitting of the Commission, the company objected that the orders were ultra vires, and declared that previous orders had only been complied with in order to avoid friction. Mr. J. L. Perron, the company's advocate, stated that at one time the company were willing to facilitate the investigation as a means to improving their relations with the city, but the attempt of the Commission to dragoon the company and the campaign of a Montreal paper had influenced the company in making objections.

The Commission decided to hear special arguments on the issue raised, and on Friday, January 17, Mr. Perron put the case for the company before the Commissioners. In brief it was that the contracts between the company and the municipalities covered all points which might arise, and that this, together with lack of specific authority on the part of the Commission, showed that the latter had no jurisdiction. Judgment will be given later.

In connection with the company's relations to the city of Montreal, the Board of Control have intimated to Mr. Robert, the president, that they cannot take up the question of the company carrying freight unless it be included in the discussion of a new contract for the entire service. The Controllers complain that they cannot get the company to seriously discuss the matter of a new contract, and that it is put off from time to time.

The repeated attacks on the Montreal Tramways Company, for alleged defective service, has resulted in a statement from the directors. In reply to criticisms that insufficient money was being spent to meet the needs of the increasing population, the auditor states that the company spent for new equipment, betterments and improvements from 1908 to 1911, annual amounts ranging from $729,368 to $871,193, while for the eleven months of last year $1,238,240 was expended. All these amounts included the money spent on subsidiaries as well as on the main undertaking. The following statement shows the new cars scrapped and added during the past five years:

	Cars	Seating capacity
Cars added since January 1st, 1911 ...	140	5,667
Cars scrapped since January 1st, 1911 ..	34½	1,175
Balance added in two years	105½	4,492
Average per year	52	2,246
Cars added in five years	177	7,223
Scrapped during same period	57½	1,937
Balance added	119½	5,286
Average per year	24	1,057

Two hundred and ten of the latest p.a.y.e. type of steel cars, with a seating capacity of forty per car, are on order, and these are to be delivered at the earliest possible moment. While the company are providing an additional seating capacity of thirty-five per cent. the population of Montreal is only growing at the rate of 10 or 15 per cent. per annum.

The Sons of Jove

There was a particularly merry gathering of the Sons of Jove at a joviation and rejuvenation held at the Windsor Hotel, Montreal, on the night of January 20. Nearly one hundred were initiated, and the proceedings were of a decidedly lively character. The candidates were escorted in Indian file through the corridors of the hotel by members of the Order, the procession being headed by a banner bearing the announcement: "These are Jovians." The members of the degree team comprised the following: Messrs. F. J. Watts, Jupiter; R. J. Hiller, Neptune; T. H. Bibber, Pluto; D. H. Ross, Vulcan; F. W. King, Hercules; F. J. Parsons, Apollo; E. W. Sayer, Avrenim; A. D. Smith, Mars; and A. H. Davies, P. S. Ferguson, W. E. Marvin, and L. A. Johnston, imps. Mr. James Bennett presided at the banquet and the subsequent initiation of candidates.

C. G. E. Equipment

The St. Lawrence Bridge Company have contracted to purchase from the Canadian General Electric Company a large quantity of machinery to be used in the construction of the superstructure of the new Quebec bridge. The equipment includes six 250 kw. transformers, six 40 kv.a. transformers, four 250 kw. motor-generator sets, and a quantity of high and low tension switching apparatus. The motor-generator sets will be used for supplying direct current to the crane and hoist motors, while part of the transformer capacity will be utilized for power for the air compressors. Work on the bridge will begin at both ends, and the plant will be divided in order to facilitate this order of work.

Northern Electric Notes

Messrs. Pike, Doherty and Newton spent the Christmas week in the United States.

Mr. W. E. Leigh, foreign sales manager of the Western Electric Company, was a recent visitor at headquarters.

We regret to have to announce the death of Mr. Alex. Farrell, long connected with the engineering department of this company.

The annual sales managers conference which was held at Montreal during the week of January 20th was a success in every sense of the word, and terminated with a dinner on Friday, the 24th.

Miscellaneous

The Montreal controllers have voted $9,088 for 175 new arc lamps which are mainly for new wards of the city. This will make a total of 300 new lamps in two years. The distribution of the lamps is left to the discretion of Mr. Parent, superintendent of the lighting department. The total amount voted for street lighting for the season is $230,000.

It is understood that it has been decided to offer $8,000,000 bonds at 90 with 25 per cent. bonus of common stock, shareholders in the Montreal Light, Heat & Power Company and in the Shawinigan Water & Power Company being given the opportunity to subscribe to the issue in the proportion of 30 per cent. of their holdings of Power and Shawinigan.

The Montreal Tramways Company are adding to their equipment at the Central Station, William street, a 2,000 kv.a. synchronous motor, with a 1,500 kw., 600 volt direct connected generator. The Canadian Westinghouse Company will supply the machines. The Tramways company will also install a 15-ton mono-rail hoist, supplied by John Millen & Son, Limited, Montreal, for handling the machinery and for repair work.

The dividend of the Kaministiquia Power Company has been raised from four to five per cent. The number of directors has been reduced to six, and Mr. J. S. Norris, general manager and secretary-treasurer of the Montreal Light, Heat & Power Company, and assistant secretary and treasurer of the Kaministiquia company, elected a director. At the annual meeting, Mr. H. S. Holt was re-elected president of the company, with Mr. C. R. Hosmer vice-president. The general superintendent and secretary of the company is Mr. W. L. Bird.

February 1st has been fixed as the date on which the new Bell telephone rates come into operation in Greater Montreal. By order of the Railway Commission, the flat rate of $55 and $35 for business and residence telephones respectively, will be extended to the territory north of the St. Lawrence within a radius of six miles from the main exchange in Montreal, which, it is estimated, will mean that the increase in the zone will be equal to one-fourth of the old area. Beyond that zone mileage may be charged only on the portion of the subscribers' line located beyond the flat zone area.

The Montreal Council have voted $25,000 for the continuance of the work on plans for laying all cables under ground. The plans for St. Catherine street are practically complete, and tenders will be called for the laying of conduits during February. The surveying of Bleury street and part of Park Avenue is done, and the surveying of nearly all Dorchester street completed. Work has also been commenced on the surveying of Sherbrooke street. Thus the surveying of the main thoroughfares in the west portion of the city is in hand.

At the annual meeting of the Montreal Telegraph Company, it was announced that out of the revenue (8 per cent guaranteed on the company's capital) derived from the operation of the company's property by the Great North Western Telegraph Company, $160,000 were paid out in dividends in the past year. From the revenue derived from the investment of the company's contingent fund, the eleventh annual bonus, amounting to $5,000, was distributed among shareholders, making the total distribution to the shareholders for the year $165,000.

Canada's Prairie Provinces

The demand for electrical power in Western Canada is increasing at a remarkable rate, and will do so for several years to come. Towns and cities are filling up with greater populations, commercial industries are coming in, and every year enlarging their capacities and extending their plants, to keep pace with the wants of the growing West. This demand is supplied to a great extent by the hydro-electric power companies, wherever water power is available.

The Calgary Power Company duly recognized this growing demand for power in deciding to increase the output capacity of their present generating station situated at the Horseshoe Falls on the Bow River, and to erect a new hydro-electric plant at the Kananaskis Falls two miles above the Horseshoe Falls. Both of these extensions are already under way and are to be rushed to completion with all possible speed.

Horseshoe Falls Power House.

The present capacity of No. 1 plant at Horseshoe Falls is about 12,000 horse-power, which supplies power to the city of Calgary and to the Canada Cement Company, at Exshaw. Electricity is generated at 12,000 volts and for the city of Calgary is stepped up to 55,000 volts and transmitted over a double pole line, a distance of about 60 miles. To Exshaw power is transmitted at 12,000 volts over a two circuit pole line a distance of nearly 8 miles.

Extensions to No. 1 plant will consist of a 6,000 h.p. turbine, supplied by the Wellman-Seaver-Morgan Company, of Cleveland, Ohio, controlled by Lombard governors, and a 4,500 kv.a., 12,000 volt, 3-phase, 60 cycle generator supplied by the Canadian General Electric Company. Two extra 3,000 kv.a., 3-phase, Canadian Westinghouse transformers will also be installed and switching apparatus to accommodate the new capacity of the plant. The present generating station will then be capable of supplying approximately 18,000 horse-power.

New Dam at Kananaskis Falls.

Some features of the new development at Kananaskis Falls are worthy of note. Immediately above the falls the Kananaskis river empties into the Bow, and at once narrows to a deep gorge, the river bed and the almost vertical banks being mostly hard pan rock, providing a very suitable site and foundation for dam. Owing to the narrow gorge across which the dam will be constructed, the amount of material utilized and therefore the cost of construction will be moderate. The structure will be of reinforced concrete, the quantity of cement for the work being estimated at upwards of 24,000 cubic yards at a probable cost of eight dollars per yard. Provision will be made in the dam for two flumes leading to the turbines in the power house. Owing to the Kananaskis and Bow being mountain fed streams it is necessary that the building of the dam, etc., be mostly carried out at low water in the winter months.

The power house will be erected on the south bank of the river just below the dam, an estimated 7,000 cubic yards of cement being used in connection therewith. The hydraulic equipment will consist of two downward-flow reaction turbines fed by two flumes from dam, and discharging into a tunnel leading to the lower level below the present falls. With this arrangement of dam and turbines an available head of seventy feet will be obtained. Turbines and generators will be of vertical type. The former will be supplied by the Allis-Chalmers-Bullock Company their gate openings and speed controlled by governors manufactured and installed by the same company.

Generating equipment will consist of two vertical shaft type, direct-connected generators, supplied by the Swedish

General Electric Company, 3,750 kv.a., 12,000 volts, 3-phase, 60 cycle giving a station capacity of 10,000 horse-power. The 12,000 volt busses will be direct connected to the Exshaw transmission line, thus eliminating step-up transformers. With this arrangement complete Exshaw or Calgary can be fed from either power house, the two stations being tied in together, giving the Calgary Power Company a most complete and efficient hydro-electric power system of 28,000 horse-power.

The total cost of construction and installation work is estimated at upwards of $1,500,000. The design and construction are being prosecuted by the company's own engineers; Mr. More is managing engineer for the company, Mr. H. S. Johnson, resident engineer, and Mr. Allen, construction engineer.

Fort Frances Telephone System

The council of the town of Fort Frances, in accordance with a largely signed petition, have decided to proceed with the installation of a new telephone system in the town. This system is to be under the control of the council, at least for the time being. We print herewith a copy of the specifications, which will doubtless prove of value to other towns similarly situated. The plans are on file at the office of the Clerk of the Town of Fort Frances, Mr. J. W. Walker.

The operating room will be located in the Town Hall and will consist of space for a switchboard. This room should be well ventilated and have an area of at least 120 square feet. The terminal room should be large enough to take care of line and cable racks, which will accommodate 500 metallic lines, and the necessary batteries and charging apparatus, including power ringing machine.

Switchboard.—The switchboard shall be of standard make and operate on central battery. It shall have 300 line capacity with 200 lines completely equipped and shall be so built, that it can be added to from time to time if necessary. It will be fully equipped with two operators positions. The line signals may be of either mechanical or a lamp signal type, operated from a central battery, either storage or dry cells. The switchboard shall have a capacity of 45 pairs of cords with 30 pairs installed, each pair of cord shall have double supervision, either mechanical or lamps. The board shall have an extra strip installed and wired to take care of twenty rural or toll lines, with ten lines completely equipped and installed. The cords for taking care of toll, trunk or rural lines will be equipped with repeating coils and necessary apparatus to connect with the lines of the common battery system. There shall be one line pilot signal for each operator's position for calling and disconnecting subscribers. These pilot signals may be of either the mechanical or lamp signal type. Each operator's position to be equipped with night bell and hand-power generator and switching key, also master key for four party, semi-selective ringing.

Terminal Room.—The terminal rack shall be of approved type and any of the following makes may be used:—American Electric Company, Frank B. Cook, or Northern Electric Company. The rack shall have an ultimate capacity of 500 lines, with 300 lines equipped on the terminal or line side and 250 on the protection side. The protection shall consist of carbon blocks and heat coils.

Storage Batteries.—If a full lamp signal type of switchboard is used, then storage batteries in connection with same shall be of approved type, governed by Bell Telephone Company, Limited. specifications. They shall have a capacity of 8 miles of standard cable and 500 telephones, the charging apparatus and ringing machine shall be governed by the same specifications and the required capacity.

Subscribers Telephones.—The telephone shall be for local and long distance talking, an approved standard pattern as adopted by Manitoba Government Telephones, Government Telephone Department of Saskatchewan, and shall conform with the Bell Telephone Company of Canada. The wiring of the subscribers houses, offices, etc., shall also be aproved by above standards. The telephone can be either Local Battery or C.B. talking.

Pole Line Construction.—All pole line construction shall follow the diagram as shown on the attached map. Any changes or alterations to be made only on the approval of the engineer in charge of the work. The material and work done shall be of standard construction, conforming to specifications of above-mentioned companies.

Brandon, Man.

It is understood that application is being made by the municipality of the city of Brandon to the Manitoba legislature for a charter to build and operate a radial railway covering a large area of land surrounding the city. The proposed electric railway will, it is claimed, connect all the small towns in the district, making Brandon the centre of a large system. It is calculated that much of the road can be constructed at a cost varying from $7,000 to $10 000 a mile. This cost will depend somewhat on the type of rolling stock adopted, a question which has scarcely been discussed as yet.

The contract has been closed with the Brandon Electric Light Company, Mr. G. A. Patterson, general manager, whereby the company agrees to supply power for the operation of the new municipal street railway system, which is practically completed in Brandon, at a rate of 2 cents per kw. hour. This contract is to hold good for two years at least, and at the end of four years the city has the option of purchasing the company's plant at its actual value as arrived at by arbitration. The Brandon Electric Light Company have both water and steam supply, and are one of the few companies operating in Canada who utilize their exhaust steam for heating purposes throughout the town.

Regina, Sask.

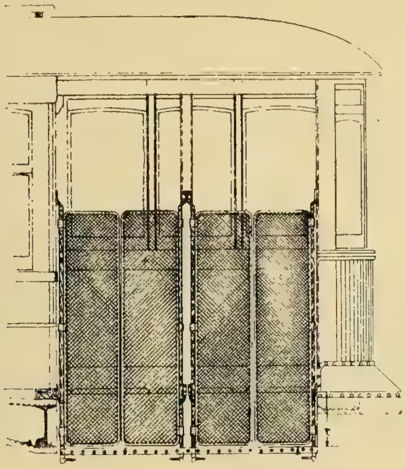
It is understood that the Regina-Moose Jaw Interurban Railway Company will be given powers of incorporation at the present session of the Saskatchewan legislature as the Private Bills Committee has reported the bill. This bill gives the company power to issue bonds at $12,500 a mile for a line of electric railway between the boundaries of Regina and Moose Jaw. Subject to the consent of the two municipalities concerned, running rights only may also be secured over the two city lines. Regina city is given power to expropriate any part of such lines as may subsequently fall within the city limits. A similar right is also conferred on the city of Moose Jaw if at any time it buys out the Moose Jaw Electric Railway Company. The same right however, of expropriation, is not granted the Moose Jaw Electric Railway Company.

Edmonton

The Siemens Company of Canada have received an order for a 5,000 k.v.a. 3-phase, 60 cycle, 1,800 r.p.m. turbo-generator for the city of Edmonton. This machine will be direct coupled to a Willans and Robinson turbine manufactured in England. The generator will be provided with Siemens system of axial ventilation so arranged that the hottest temperature in the machine can be measured. The rotor will be of the solid type. In addition to the above generator the Siemens Company have already supplied or have on order for the city of Edmonton:—One 2,000 kw. turbo-generator, one 750 kw. street railway generator, and one 425 h.p. induction motor.

A Busy Month Along the Coast

On January 1st, 1913, the new rules of the British Columbia Government, regulating the operation of electric railways within the limits of the province, came into force. The important items of the new rules cover the limitation of the number of passengers allowed on the cars and the provision of gates or doors at the entrance or exit of all cars. The thirty-five city cars recently purchased by the B. C. Electric Railway from the Brill Company, are equipped with gates at both the entrance and the exit passages of the rear platform, the controlling levers being operated by the conductor. The exit door of the front platform is combined in operation with a folding step. As the rear platform gates are flush with the body of the car and open outward, there is no chance of persons attempting to board the car at either platform while it is in motion, thus giving additional protection from step accidents. A number of the gate cars are now in service in Vancouver and the B. C. Electric will install gates on all its cars as traffic demands permit.


B. C. E. R. gates

The regulation governing the capacity of the cars stipulate that a load shall be the sitting capacity of the car and one standing passenger for each four square feet of standing room. When the capacity of the car is reached, a sign "Car Full" is displayed over the entrance to the rear platform and additional passengers are not taken on until passengers have left the car. Signs are posted in each car giving the seating and standing capacity according to the new regulations. The regulations now make it an offence against the provincial law for persons to ride on the steps of the car and the company and the conductors in charge are directed to see that this rule is enforced. The regulations demand that all city street cars must be of the double truck type and that the height of the step from the ground to the first step must not exceed 16 inches.

New Westminster Gets Good Contract

The city authorities of New Westminster have entered into a contract with the B. C. Electric Railway Company for electric current for the municipal lighting plant, the agreement covering a period of 11 years from January 1, 1913. The New Westminster authorities control the public and private lighting facilities in the city and have been securing their power from the B. C. Electric on a contract which expired December 31, 1913. Recently the council called for tenders for current for its lighting plant for a period of ten years. On December 24th two tenders were opened, these being presented by the B. C. Electric and the Western Canada Power Company. The B. C. Electric offered current to be delivered to the city at the company's sub-station at 2300 volts for 1.25 cents per kw. hour. The company was to furnish switchboard, regulators, transformers, etc., and also to bear the operating expenses of the sub-station. The city was to guarantee a minimum annual output of 2,500,000 kw. hours. Should the city desire and could satisfactory arrangements be made the company would erect a second sub-station so that current could be taken from two points. The Western Canada Power Company submitted an offer for 1.5 cents per kw. hour, the city to provide a sub-station and the company to provide the electrical apparatus and be responsible for the operating expenses in connection with the station. As an alternate offer, the Western Canada Power Company submitted the price of 1.3 cents per hour should the city erect, equip and maintain the sub-station.

On its present contract the city was paying the B. C Electric 1.46 cents per kw. hour and contributing $100 per month for the up-keep of the sub-station. In view of the better terms offered by the B. C. Electric, an arrangement was made between the company and the city whereby the remaining year of the old contract was transferred and a new agreement for an 11-year term entered into at the lower rate noted in the company's tender.

Destructive Gales

On December 30-31st a gale of unusual violence occurred on the British Columbia coast causing considerable damage to the light and power lines of the British Columbia Electric Railway. The gale swept up the Fraser River with great violence, wrecking the three high towers which carried the light and power lines of the company from Lulu Island to Ladner and the Delta district. These towers were of heavy timber construction and 320, 250 and 175 feet in height respectively. The foundations of the highest tower were partially washed away owing to the changing of the course of the Fraser during the flood and this tower succumbed to the force of the wind, the others falling shortly after. The company is replacing this connection with the Delta district by pole lines giving land connection. In Vancouver the full force of linemen were kept on duty day and night attending to the many trouble calls on account of the gale. During the height of the storm the guy wires of the 165 feet masts carrying the company's lines over the Main street bridge, Vancouver, parted, and for a time these lines were in great danger of falling. All traffic was temporarily suspended over the bridge on account of the danger but the company's linemen succeeded in replacing the guy wires while the gale was still raging. Considerable damage was done by the storm to the electric signs about the city, a number of large constructions of this class on the roofs of high buildings being destroyed.

B.C.E.R. Bond Issue

During the early part of January the B. C. Electric Railway Company, Limited, asked for subscriptions for an issue of £750,000 of 4¼ per cent. debentures, the issue being floated at 98. The offer was made in London, the concern being chiefly backed by old country capital. On the closing of the subscription books, it was found that the issue has been oversubscribed. In commenting on the successful floatation the daily press of Vancouver, B.C., in both editorial and news articles called attention to the advantage of the tramway and light and power service of the coast district of British Columbia being under the direction of a company in which such confidence is felt in the old country as was shown by the taking up of such a large loan at this time. The article points out that while the issue of the B. C. Electric was successfully floated, many western muni cipalities have been vainly endeavoring throughout the year to float municipal debentures in the Old Country, and, because of their failure to accomplish their ends, have been obliged to issue short term treasury notes bearing a high rate of interest. The new issue of the B. C. Electric is intended to cover the large development works and extensions which the company has in hand for the coming season.

Mr. Sperling Back From Europe

Mr. R. H. Sperling, general manager of the British Columbia Electric Railway Company, returned during the month from an extended trip to the Old Country and Europe. During his stay in London he conferred with the directors of this company concerning the operations in British Columbia. On his return to Vancouver Mr. Sperling was greeted with great enthusiasm by the company's staff and received hearty congratulations on his improvement in health. On January 6th the office staff of the company tendered a formal reception to the general manager in the rooms of the B. C. Electric Social Club. Over 250 were present at this gathering, the principal feature of which was an address by Mr. Sperling, in which he stated that the attitude of the directors toward the Social Club was of a favorable character, as it was believed that such an organization promoted a spirit of cooperation and harmony which it is desirable to secure among the employees.

Miscellaneous

The Port Essington Water Company, Limited, has been granted a certificate of incorporation, head office at Vancouver, B.C.

The Bridge River Power Company, Limited, has been incorporated with a capital of $2,000,000, to carry on the light and power business in all its branches, with head office at Vancouver, B.C.

The equipment for the Penticton, B.C., power plant arrived early in January, and it is expected the plant will be in operation about the middle of February. Mather, Yuill & Company are in charge of the installation.

Messrs. Waugh, Mesner & Bailey, of Vancouver, recently commenced the installation of 219 ornamental cluster light standards to be located on Main street, Granville street, Harris street and Hastings street, Vancouver. All standards will be equipped with five 100-watt tungsten lamps, wired in multiple at 110 volts on 3-wire system.

Mather, Yuill & Company, Vancouver, B.C., have just completed the construction of about twenty-five miles of high tension pole line for the Canadian Collieries, (Dunsmuir), Limited. This line is in connection with their new hydro-electric installation to supply the various coal mines around Comox, Vancouver Island.

The firm of Mather, Yuill & Company, consulting and contracting engineers, Vancouver, B.C., were recently awarded the contract for the supply and installation of a 150-h.p. Diesel engine for the city of Port Alberni, Vancouver Island, B.C. This firm were also awarded the contract for the erection of all other equipment in connection with the power plant.

The Black Mountain Water Company, Limited, has been incorporated with a capital of $600,000, with head office at Kelowna, B.C. In addition to obtaining the usual licenses, the company is empowered to purchase the irrigation works erected by the Belgo-Canadian Fruit Lands Company, together with the lands and rights-of-way used in connection therewith, near Kelowna, B.C.

The 150 h.p. Diesel engine, Westinghouse generator and switchboards have arrived at the city of Vernon, B.C., and are now in course of erection. The 150 h.p. Diesel engine has also arrived for the municipality of Spallumchean, Armstrong, B.C., and is now being erected. Mather, Yuill & Company are installing both these plants and expect to have them in operation by the end of January.

During the month the British Columbia Electric Railway inauguarated a service over its new track on the Lulu Island line between Vancouver and Eburne. This line belongs to the C.P.R. and is operated by the B.C. Electric on a long lease. As originally constructed the entire line was a single track, but, owing to the rapid development in the Point Grey district, due to suburban settlement, traffic demands have increased so that a double track from Vancouver to Eburne was constructed last year. Operating over the double track line a 15-minute service is now given during the rush hours between Vancouver and Eburne.

The B. C. Electric Railway Company has concluded arrangements with the authorities of New Westminster for the establishment of a terminal yard in that city. The location of the yard is on a block between 4th and 5th avenues and 14th and 15th streets. The plans call for a construction of 19 separate tracks for main lines and switching, the total trackage of the yard being about three miles. This yard will be connected with the three interurban lines operating between New Westminster and Vancouver as well as the three suburban and interurban lines operating to the south and west of the city, the principal division being that operating through the South Fraser Valley to Chilliwack.

During the month the British Columbia Electric Railway Company operated a "nearside" car over its Vancouver line. The car is similar in type to those now used in Philadelphia, it being supplied by the J. G. Brill Company. A careful watch was kept during the test runs to ascertain whether the car showed any improvement in the handling of traffic. These figures have not yet been given out by the company owing to the desirability of still further testing the type of car. The B. C. Electric has recently received from the J. G. Brill Company a stepless centre entrance car, similar to the "5,000" type in use in New York City. The car is now being made ready for operation and will probably be taken out on test runs during the month.

To accommodate the demands of the merchants of Vancouver and New Westminster and the settlers and retail stores scattered throughout the South Fraser Valley, the B. C. Electric has just instituted a fast daily express service between Vancouver and New Westminster and Chilliwack. The train leaves Vancouver early in the morning, arriving at Chilliwack about 1 p.m., the return trip being made so that the train arrives in Vancouver during the early evening. This service will be of great value during the summer when large shipments of produce come to New Westminster and Vancouver from the South Fraser district, the train being so timed as to bring the produce in fresh condition to the market.

Canadian Telephone Progress

Previous to the 10th of November last, telephone communication between Vancouver and North Vancouver was maintained by means of cables which crossed the First Narrows of Burrard Inlet in the water mains of the Vancouver city waterworks department. The large increase in telephone business between these cities during the latter part of 1912 rendered the old circuits inadequate, and in order to provide an improved service the B. C. Telephone Company decided to lay a submarine cable across Burrard Inlet. This cable—probably the first of its type to be installed on the American Continent—is a 50 pr. 19 ga. Nutti duplex, paper insulated, lead covered, single armoured submarine 12,407 feet in length. It was manufactured by the British Insulated & Helsby Company, London, in accordance with the B. C. Telephone Company's specifications, and was shipped on three reels, each weighing eighteen tons.

In a duplex cable of this type, two conductors are twisted together, thus forming a pair. Two such pairs are then twisted together, forming what is known as a quad. Two of these quads are next intertwined, forming a secondary quad, the object of this form of cabling being to allow the use of phantom circuits, and also the phantoming of the phantom circuits. The cable contains 12 secondary quads and 1 quad, thus making it possible to secure 87 talking circuits. Because of the capacity, unbalance between conductors in each section of cables, it was found necessary to test the three sections of this cable in order to locate the various conductors whose capacity unbalances, when spliced together, would tend to neutralize each other and ensure freedom from cross talk.

Telephone cable on scow

The tests were made by the Engineering Department of the British Columbia Telephone Company, and a Capacity Unbalance Testing Set was used for the purpose. That the selection of conductors was successful is evident from the fact that there is absolutely no cross talk.

The cable was laid between Vancouver and North Vancouver on November 10, 1912, the time consumed in the process being about one and a half hours. The cable was unreeled and coiled on a scow, the ends of each section being thoroughly tested and spliced as the cable came off the reel. The scow was equipped with a gallows frame amidships, and an 18-in. shear at the stern, the cable passing from the forward end of the scow over the frame, and then over the shear as the scow was towed along. The splices were relieved of strain by making a rope fast ahead of each, and allowing the rope to bear the strain until the splice was on bottom, the rope being then cast off. The average depth of water along the course is about 100 feet. The standard cable equivalent of the submarine in place is two and a half miles. (Standard cable—.054 M.F. 88 ohms. per mile). Twenty of the circuits are at present in use and the cable has proved satisfactory in all respects.

Much careful work is required in perfecting a connection of this kind, and considerable of this fell to the lot of Mr. E. P. Labelle, plant engineer of the B. C. Telephone Company, and Mr. A. H. Lemmon, district engineer. Laying of this connection was effected under the direction of Mr. G. McCartney, superintendent of construction, assisted by Mr. H. B. Noble, division foreman, and Mr. E. W. Thomas, construction engineer.

Pure Enunciation

To eliminate enunciation troubles, the Traffic Department of the British Columbia Telephone Company, Vancouver, B.C., has begun the training of the voices of operators. This work is under the supervision of the training school principal, who has secured the services of a competent elocution teacher. The company has a situation that is no doubt exceptional, in that young ladies of so many different nationalities are employed as operators. While all these speak the English language, it is rather a variation of that language, hence the need for a school where prospective telephone operators will be instructed in the duties which, as operators, will fall upon them.

All student operators will be given a course in voice culture, which besides the regular voice training practices, consists of breathing and calisthenic exercises. All operators will be thoroughly drilled in the pronunciation of the phrases given in the company's operating practices, as well as in numbers and central office prefixes. Because an operator is trained to act quickly, the natural inclination is to speak quickly, to mumble her words, and to cut out before the repetition is complete. The elocution teacher's endeavors will be to train the operator to speak slowly and as far as is possible to have all operators speak the "Canadian language." The classes now conducted are in one of the exchange buildings. Because of the growth of the traffic department and the increasing demands on it, through the development of the company, the erection of a separate building for school purposes has been found necessary. Plans for a suitable structure were prepared by the company's engineers last November, and building operations were commenced without delay on the site chosen, at the corner of 10th avenue and Prince Edward street, Vancouver, adjoining the Fairmont Telephone Exchange. The building measures 36 x 58 feet, and is of steel frame construction faced with buff pressed brick and stone. All floors are cement, and hollow tile is being used for the partitions. Provision is made for the addition of several storeys in the future.

All interior woodwork is B. C. fir. Upwards of forty pupils can be accommodated in the school at one time. The construction department of the B. C. Telephone Company is erecting the building.

Yarmouth, N. S.

The new switchboard in Yarmouth, N.S., was successfully put into operation on the 4th of December, 1912. In addition to this the Maritime Telegraph and Telephone Company, cut over a new switchboard in Glace Bay on October 9th, and a new toll board in Halifax, on November 30th. Yarmouth now has a modern common battery No. 10 switchboard located in an attractive concrete and stone building. The building is two-storeys and fire proof throughout. On the first floor are the commercial and manager's offices, and the work shop. The second floor contains the battery room, wire chief's room with the main frame and power apparatus, the switchboard room and the operator's rest room. The building has good light on all four sides, which makes all the rooms very bright and pleasant for the employees.

The switchboard is a four position No. 10 Common Battery Board. There is one straight toll position, one combination recording, rural line and toll position and two local positions. An intermediate distributing frame associated with the switchboard makes it possible to arrange the lines on each position as to give each operator a good load and and thus prevent any delays due to an overloaded position. Another good feature regarding the arrangement of this switchboard is that extensions can be made to it in both directions. Additional toll sections can be added to the right hand side of the board to handle growth in the toll business and the local sections can be extended to the left hand side of the board.

The work of installation of the Yarmouth board occupied a period of only seven weeks. Messrs. Felix & Soule, of the Northern Electric had charge of the work.

New Bell Buildings

The Bell Telephone Company of Canada will shortly erect buildings of their regulation standard—two-storey, with high basement, brick and stone front, fireproof construction—in Belleville, Guelph, North Bay, Sudbury, St. Catharines, and Brockville. In Toronto, the company will build a new Hillcrest exchange on north Bathurst street, as well as a new structure at Eglinton. These buildings will be similar to the present "North" exchange building in Toronto. In Ottawa a new exchange building will be erected on First Avenue, near Bank street, similar in structure to the present "Rideau" exchange. In Sherbrooke, Que., the company will erect a three-storey building at Strathcona Square and Terrace street. A contract has been let for a new exchange at Outremont, P.Q.; it will have a frontage of 100 feet and will be two storeys high.

Extensions in Scarboro Township

At the recent annual meeting of the Scarboro Telephone Company, it was stated that the total number of telephones now installed is nearly 400, of which 50 have been added during the past year. The indebtedness of the company is being reduced and at the same time ample allowance is being made for depreciation. It was decided that in the event of the Hydro-electric Commission deciding to operate throughout this township, the company should approach them with a view to having distribution power lines run along telephone poles. This would result in a reduced cost in power and light to the consumer and should also tend to reduce the telephone cost. Councillor Mr. G. B. Little was elected president of the company.

Miscellaneous

On January 1, 1912, the British Government took over the assets of the National Telephone Company, of the United Kingdom. The sum to be paid to the company was submitted to arbitration, though the amount asked was $105,000,000. During the trial, which has lasted some two and one-half months, several concessions were made by the company which it was expected would reduce this sum to $80,000,000 or $90,000,000. The decision of the Commission, however, is said to be a great surprise to all concerned, and places the sum payable by the government to the company at only $62,576,320. The Commission consisted of five judges of the High Court.

The Bell Telephone Company will make a new stock issue of $3,000,000, bringing their total issue to $18,000,000. Each stockholder of record January 15 is entitled to take at par shares of the new stock in the proportion of one share for every five shares held. The right to subscribe expires on February 28.

On February 1, the flat rate goes into force over a considerably larger area in Montreal, following the recent decision of the Railway Commission which had the matter in charge. It is said that many suburban residents of Montreal will now get their telephone service cheaper by amounts varying from $5 to $20 per year.

The British Columbia Telephone Company is said to be preparing plans to build a line to Kalso from its present terminus at Kakanee. It is also said that an exchange will be established at Kalso and service provided for surrounding districts.

The number of telephones operated in Vancouver city during 1912 by the British Columbia Telephone Company was 16,160. At the end of 1913 this number has been increased to 21,321, an actual increase of 5,161.

It is said that some $5,000,000 will be expended on the Alberta telephone system during the year 1913 and that this has already been provided for by the sale of government securities to this amount in the old land.

De Laval Type Steam Turbines

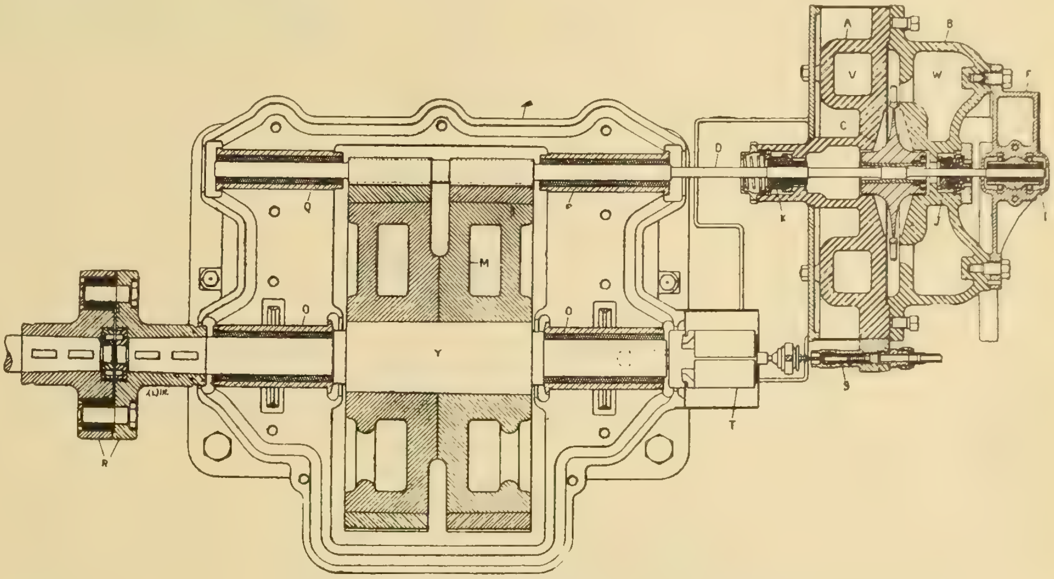
Messrs. Taylor & Young, consulting engineers, Metropolitan Building, Vancouver, B.C., were recently awarded a contract by the Dominion Government, Department of Dredges, for the supply and installation of a De Laval steam turbine of the single-stage geared type. The machine supplied by this firm, who are engineers for the De Laval Company, and specialists in this class of installation, is a 4.6 kw. 125 volts, Direct Current Generating Set, consisting of one De Laval class "A" 7 h.p., 3,000 r.p.m. single geared steam turbine, direct connected to one Crocker-Wheeler 4.6 kw. 125 volts direct current generator, generator and turbine to be mounted on a suitable bed plate. The turbine is designed to carry the full load of the generator on either steam at 150 pounds steam pressure at the turbine throttle, with six pounds absolute vacuum at the turbine exhaust, or with 150 pounds pressure at the turbine throttle and atmospheric pressure at the turbine exhaust.

In this class of turbine the steam is expanded completely to the terminal pressure in one set of nozzles, and impinges against a single row of blades or buckets carried by a single wheel. The speed is reduced by means of a helical pinion and gear to suit the driven machine.

An important feature of this turbine is the advantage it possesses over multi-stage turbines in regard to its ability to carry overloads. In order to carry an overload with the De Laval turbine it is only necessary to open more nozzles, and since these nozzles work at the maximum efficiency, with the losses due to windage and disc friction remaining as before, the efficiency of the turbine is increased. Some multi-stage turbines admit steam around the entire circumference of each stage, while others use partial admission in the first few stages, with complete circumferential admission in the latter stages. In either case it is impossible to increase the power output above a certain maximum without admitting a steam at higher pressure to an intermediate stage. The total range of expansion must then take place between such intermediate stage and the exhaust end of the turbine, and, inasmuch as that part of the turbine is designed for only a fraction of the total range of expansion, the operation of a multi-stage turbine under overload conditions is necessarily inefficient.

Speed reduced by gears is the peculiar and distinguishing feature of the De Laval turbine, and to it are due many possibilities and exclusive advantages. There is a general and natural objection to the introduction of gears where they can be avoided, but here, as in all branches of engineering design, the advantages and disadvantages of one construction have to be balanced against those of another before a final judgment can be passed. In other words, the use of gears eliminates certain undesirable features, therefore if gears can be made that will perform the duty, with low cost for maintenance, little attention and good efficiency, is not the use of such gears the logical procedure?

By the adoption of gears, the De Laval Company is enabled to use the most simple and efficient type of wheel, viz., the single impulse wheel, and to run the driven machine at the most desirable speed. In non-geared turbines this compromise, which has here been effected by means of the gear, must be made by pressure or velocity compounding, or both, but the resulting complication is greater, and the results are not so satisfactory as when the speed reduction is secured by the simple expedient of a gear. At best, the compounded turbine does not run as fast as could be desired on the grounds of efficiency, and the driven machine is compelled to run too fast. This is true to a greater extent than is generally appreciated, as the usual turbine speeds are altogether too high for direct-current generators, and the construction of high speed alternators involves many difficulties. It is almost impossible to build a commutator having sufficient current-carrying capacity and, at the same time, to keep its peripheral speed within practical limits. Therefore, where direct current machines are driven from multi-stage turbines, it will usually be found that two or more small-diameter commutators, occupying considerable length on the shaft, are required. The maintenance of these commutators in balance presents a problem beyond the skill of the ordinary operating engineer. In the case of alternating current machinery, the efficiency of the generator must be sacrificed to some extent by reason of the small diameter and limited space available. While it may be possible for the manufacturer to balance the rotating part satisfactorily at the shop, the balance is not always retained subsequently, when, due to changes in the thickness of the insulation, the copper conductors become displaced, and, even if this displacement is very small, it will produce troublesome vibrations.



De Laval single-stage, geared type, steam turbine

The difficulties of a proper speed compromise by compounding alone are well illustrated in the case of ship propulsion, for which service several builders of multi-stage turbines have recently proposed the use of gears that in all essential respects are identical with the gears used in the De Laval turbine for the past twenty years. Now, if ships costing several million dollars and dependent for their safety upon the absolute reliability of their driving mechanism, are to rely upon the continuous operation of gears subjected day in and day out to the extraordinary severe racking and vibration, it is conclusive evidence that these turbine builders are thoroughly convinced of the durable and reliable character of this type of gear.

To return to considerations which relate more exclusively to stationary steam turbines, it will be found that the losses of energy in the gears are more than made up by the increased efficiency of the turbine and of the driven machine. Numerous tests made by the De Laval Company and others, have shown that the mechanical efficiency of the De Laval gear is between 98 and 99 per cent.

The De Laval gear is of the herring-bone or helical type, and consists of two parts—a double pinion cut directly upon the turbine wheel shaft—and either one or two double gear wheels mounted upon the secondary or driven shaft or shafts. A fine pitch is used for the teeth in order that a large number may be in contact at one time, thereby reducing the unit pressure set up between the surfaces of the teeth, thus preventing the lubricant from being forced out and keeping down the unit stress in the metal of the teeth, so that there is no danger of breakage. The teeth are cut on a spiral making an angle of 45 deg. with the axis of the shaft, and as there are two sets of teeth inclined in opposite directions, the centering of the pinion and the distribution of the pressure are automatic. The material from which the teeth of the pinion and gear wheels are formed is a high-grade steel, and the teeth are cut by special gear cutters, which were designed and built for this purpose. Long experience has shown that the success of the gear depends largely upon its initial correctness and finish. The pinion is solid, but the gear wheel is built up of a cast-iron drum upon which a seamless ring of steel is forced. After the pinion and the gear have been cut they are polished by a special process.

125 Miles More Line

The Hydro-Electric Power Commission of Ontario will issue specifications around the end of January, and will call for tenders in March, for the various materials in connection with the construction of approximately 125 miles of double circuit transmission line at 110,000 volts and the equipping of sub-stations for the transforming of 20,000 h.p. from 110,000 to 13,200 volts. Various types of apparatus will be considered; for instance, different materials for conductors and different types of steel construction for supports.

The Manufacture of Wire and Cable

A Minute Description, with illustrations, of the Successive Manufacturing Stages, with the Machines used, in Their Production

By Mr. H. O. Blatt*

In the following paper an attempt is made to describe step by step the interesting process in the manufacture of wire and cable in its various forms starting with the rod and ending with the finished product. The machines described and the process of manufacture at every point have particular reference to the plant of the Imperial Wire & Cable Company, Limited, Montreal.

Wire Drawing

Raw copper for use in this department comes to it in the shape of rods—that is the output of the "rolling" mill, in contra-distinction to wire, the output of a "drawing" mill. The rods come to the wire mill in the shape of coils weighing approximately two hundred and twenty-five pounds each, and in outside appearance resemble iron. This blackening on the outside is produced in the rod mill and is the oxide formed when the copper, after having passed through the rolls, is left to cool. These rods are supplied ordinarily in circular cross-section and in sizes from ¼-inch to ¾-inch in diameter, although special shapes, such as rectangular for magnet wire, or "figure eight" for trolley wire, are supplied.

The first operation on the rods, in order to make the product clean and the material more easily worked, is to get this heavy copper oxide off the outside. To do this, the coils are soaked for a time in large tanks containing acid and then very thoroughly washed in running water, after which they have a dull copper color. It is necessary to remove every trace of the acid, in order to have the copper in the best condition for the subsequent drawing operations, especially on the smaller sizes. Before the rods are taken to the drawing machines, each coil is dipped in a soapy solution which puts a film over the copper that helps to neutralize the acid and also forms a lubricant which assists the copper in its reduction through the die.

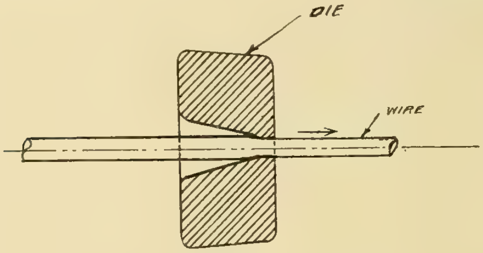


Fig. 1

One end of every rod is next put into a swadging machine where the rapidly revolving pieces of steel taper it to a point small enough to be easily passed through the hole in the die. The tapered end of the copper rod is then inserted in the hole and beyond the end of the die, and with a pull applied to the end extending beyond the die, a wire of the size of the hole is produced. A reference to the sketch of the wire and die will serve to illustrate clearly this part of the operation. The dies used in drawing copper are, as a general rule, made of chilled iron, steel or diamond. The process of drawing the copper hardens it, and after a certain number of reductions, it becomes so hard that before any further reductions can be made, it is necessary to anneal. The process of annealing consists in bringing the copper to a red heat in a furnace and then plunging in cold water, or, allowing to cool off gradually, either of which leaves the copper soft and pliable. Sudden cooling of copper does not harden it, as in the case of steel.

In deciding the size of the rod to use, it is necessary to consider, in material of circular cross-section, just what physical or electrical requirements are to be met, viz., the tensile strength, elongation, conductivity, etc., and in rectangular or square sections for magnet wire, what the area and finish of the completed article is to be. There are many kinds of machines used for drawing copper, the usual ones being "bull-blocks," "draw-benches" and "continuous." "Bull-blocks" are used for producing the large sizes of wires where a single reduction from one size to another is all that is wanted. The "draw-bench" is a machine composed of a number of blocks, and here the coils of wire are passed from one block to the other, when the reduction from one size to another is effected. "Continuous" machines, as their name implies, produce the finished wire in one operation, and as many as nine reductions are made at one time.

For producing trolley-wire, the bull-block is the machine used, and, for the most popular size, (.365-inch) a ⅝-inch or ¾-inch rod is required. It is desirable in trolley wire to have it as hard as possible, and the largest rod that can be drawn to the size required without annealing, is the one chosen. As trolley wire is always desired in long lengths, usually one mile, the several coils used to make up the length are joined by brazing with silver solder, and the entire length passed through the die. If the brazed joints are strong enough to withstand the action of this reduction, there is slight danger of the trolley wire ever parting at the joint.

The "continuous" machines produce the finished wire at a high rate of speed; a delivery of twelve hundred feet a minute is not uncommon. The large wire entering the machine is pulled through the first die by one of the revolving parts of the machine known as the "chill"; here it is pulled through the next smaller die by the chill adjoining, which revolves sufficiently rapidly to take up the increase of length, due to the reduction in the cross section. This series of operations is continued to the end of the machine, where the finished wire is either taken up automatically in a coil or on a spool.

Copper for use in winding magnets is manufactured in round, square or rectangular sections, and a special machine is required to turn out the square and rectangular. As a general rule, the square and rectangular sections are made by rolling, although the larger sections may be drawn, the holes in the dies having the dimensions of the desired finished article. The square and round sections that are not drawn are put in a rolling machine which is equipped with four steel rolls set at right angles to each other and arranged so that any roll can be moved in or out from the center, as desired. By a series of passes through these rolls, a great variety of shapes is produced. Some of this special shaped copper is shipped in the uninsulated state; the major portion, however, goes to the magnet wire department to be covered with one, two or three layers of "combed sea island" cotton.

The diamond dies previously mentioned for use on fine wire are used on sizes .064-inch and smaller. The black diamond is sufficiently hard to stand the strain of the reduction and can be polished smooth enough to allow the easy passage of copper through it. There are other materials of the same general nature used, but their life is short and they do not give the general satisfaction the diamond does. It is interesting to note that the hole in the diamond is pierced by a revolving steel drill, the end of which is previously dipped in diamond dust and oil. Either side is afterward bell mouthed and the pierced diamond mounted in a brass casing, with the sides of the hole at right angles to the face of the casing. These dies are one of the expensive items entering into the manufacture of the finer sizes of copper wire, the price ranging from $5 to $70 each. It is necessary to have a stock valued at several thousand dollars, in order to be in a position to supply the trade with the range of sizes required. Copper wire No. 40 B and S gauge, or .003145-inch, is the finest called for in any quantities, although five sizes smaller can be drawn.

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* Shop Superintendent Imperial Wire & Cable Co.

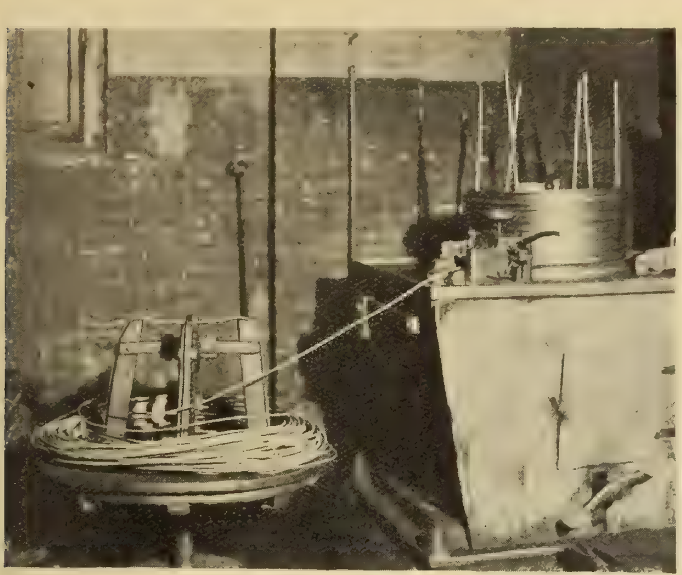

Fig. 2—Bull-Block

Testing and Distribution

Although the output is principally copper, large quantities of brass, aluminum and copper steel are produced. These are manufactured in the same general way as copper, but each requires its own special method of treatment. For all insulations except rubber—that is, where the rubber is going directly on the conductor—the copper is now a finished article of this department. To be suitable for rubber insulation, the copper must have a thick covering of pure tin over its entire surface. The tinning is done by pulling the wires, several at a time, through a molten tin bath, having previously passed through acid and water baths to remove all grease or dirt. This tinned wire is then passed to the inspection department, and, when it has met the tests prescribed, by this department, it is sent to the rubber insulating department. The uninsulated copper after passing the inspectors, is passed to the stranding, weather-proof or other departments where it is insulated in the untinned state.

The testing laboratory for use on the products of this department is equipped with the most modern instruments for determining the properties of the copper, such as, conductivity, tensile strength, elongation, ductility, etc. For the conductivity test, the Hoopes Bridge is used, in which the percentage is read off directly on the graduated scale. The company's standard for this property is set at 100 per cent. for annealed copper and 97 per cent. for hard drawn, and tests are made at regular intervals to insure the copper being up to the standard set. A Riehle horizontal tensile strength machine having a capacity of 10,000 pounds is used to determine the tensile strength and elongation of the hard drawn line and trolley wires. Wires manufactured to a specification calling for a ductility test are also put in a testing machine designed specially for that purpose.

Rubber Insulating

The most important ingredient in the rubber insulation, generally termed the "compound," is Upriver Fine Para. This is prepared from the latex of the rubber tree. This latex or sap slowly oozes from incisions made in the bark of the tree and is collected in small cups placed beneath. The contents of these cups is collected during the day and at night is taken to the camps to be coagulated; that is the name given to the process of driving out moisture and hardening the milk. The smoking process originally used by the natives and the standard to-day is much as follows:—A fire is made of palm nuts or hardwood, which give off heavy smoke containing creosote, acetic acid, etc. A long rod or paddle, supported at one end by a cross piece and at the other by the operator's knee, is held in the volume of smoke. The operator pours a quantity of latex over the rod and turns it in the smoke until a hard film is formed. A fresh quantity of latex is poured on, smoke again applied, and this continued until a 20 to 100 pound ball or biscuit, consisting of innumerable layers, is formed. After the pole is removed and the ball stamped, the rubber is ready for export to the factories.

The first operation on this crude rubber in the factory, is washing. This is done between two powerful revolving rolls, which have a fluted surface for tearing the elastic fibres apart. Water is kept flowing over the rolls while this operation is in progress, so that all bark, sand or other foreign matter is dislodged and washed off. The rubber is taken from these rolls in sheets about six feet in length and hung in heated ovens, or put under vacuum to remove all moisture. The vacuum method of drying will accomplish in a few hours, what will require about ten days in heated ovens.

The rubber, after this washing and drying, is in a condition to be mixed or compounded. The purest compound is rubber with a percentage of sulphur. Two steam heated and water cooled rolls about 20 inches in diameter, are used to mix the different ingredients with the rubber, to form the compound. The rolls have a smooth surface and are revolved at different speeds to produce the mixing. One hundred and fifty to two hundred pound batches are mixed at one time, and require about one-half hour to mix, Fig. 4. The amount of any one ingredient entering into the compound varies with the grade desired. Compounds for insulating wires must be free from foreign matter, such as metal,

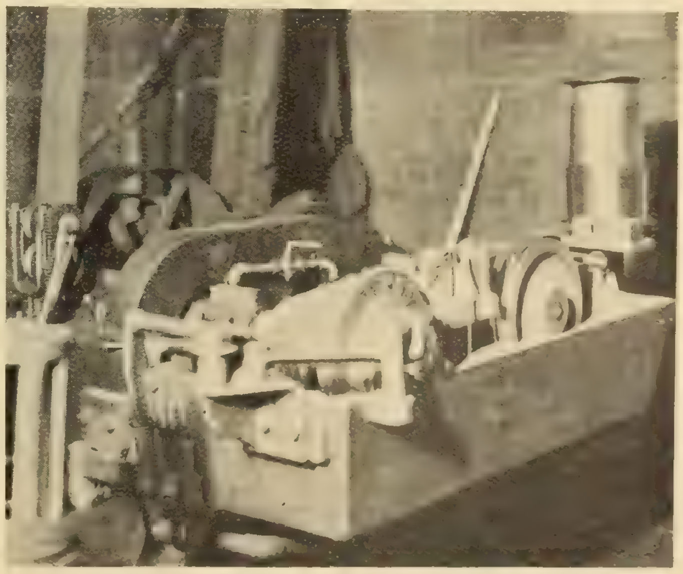

Fig. 3—Continuous wire-drawing machine

wood, fibre, etc., as a piece of any of these imbedded in the wall of the insulation will make it defective. For this reason, all the ingredients must be as clean as it is possible to make them and the wire manufacturer must be constantly on the alert, devising means to eliminate these destructive elements. All powders used must be put through fine mesh sieves, to make sure no foreign matter remains, and all waxes or oils must be thoroughly strained before being used.

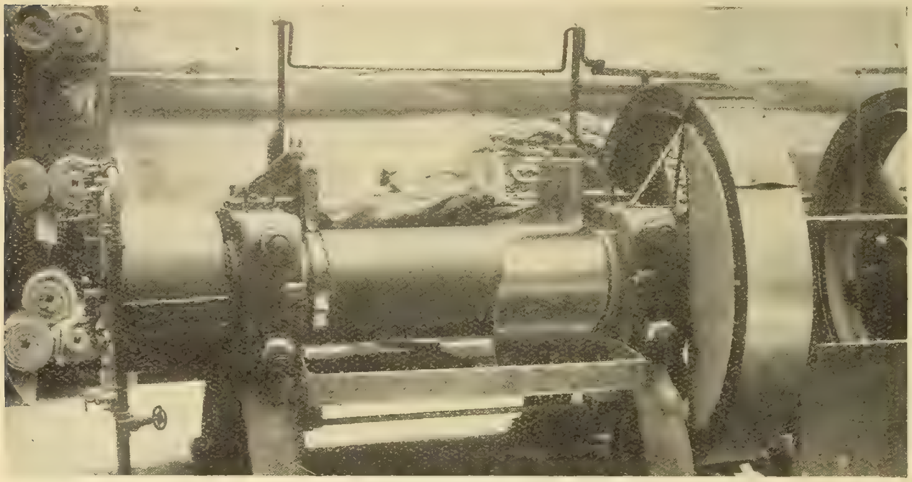

Fig. 4—Rubber mixing machine

The compound is applied to the wire generally, in three different ways:—One is to wrap the thin strip, spirally around the wire, a second, to squeeze the strip between two grooved rolls—known as the strip method—and a third, —known as the seamless method—is to force the compound around the wire in a tube machine, Fig. 5. Of the three methods referred to, the first is the oldest and now the least used, and this only on large cables. After the regular mixing, the compound is ready for the tube machine, but to be suitable for the strip machine, it is necessary to make it into thin strips of various widths and thicknesses. This is done by passing the compound through the steam heated rolls on a machine called the "callender," where it is sheeted out as desired. The compound is put in on one side of the machine and rolled up between strips of cotton cloth on the other side, the cloth keeping the several wraps of rubber separated, until they are wanted at the strip machine.

In the strip method, the two sheets of compound from the callender are passed through the grooved rolls and squeezed around the wire; the excess on either side of the wire is pressed off and the wire left surrounded by the compound has two seams. In the seamless method, the operation is the same as in the ordinary sausage grinder. The compound is fed into the hopper at the back of the machine, and the worm forces the compound around the wire, and the insulated wire, without a seam, comes out of the front of the machine.

After the compound is on the wire, if there is to be an outside protective covering, there are two general methods of procedure. One is—first to vulcanize and then braid, the other—to braid and then vulcanize. The vulcanization, or what is commonly called curing, is the result of keeping the compound containing sulphur in a steam heated oven for a definite time and gradual increase of temperature. If this has been properly done, the compound has high insulating and wearing qualities. Uncured rubber when stretched will not return to its original condition, whereas the cured, returns to its original shape, and that, directly the pressure is removed. Without this cure, the compound is lifeless and of little value as an insulation.

Whether the braid is put on before or after the cure, depends upon the insulating machine; if from the tube machine, it is put on after the cure; if from the strip machine, the braid is put on before. From the tube machine, the insulated wire is put in large pans containing soapstone. The soapstone is used to keep the wires from touching each other, and to form a cushion for the hot plastic compound that would flatten without it. As the compound is soft and very easily damaged when coming out of the tube machine, great care must be taken to prevent holes being made in the insulation, and the under covering becoming flat.

The braid is put on by machines, the elementary principle of which is the familiar May-pole Dance. The tubes containing the material for the braid are sent in and out around the table of the braiding machine, and a continuous layer of the material is formed around the wire, Fig. 6. The oldest and most widely used machine turns out five hundred feet per day, depending upon the style of wire, although there is a high speed machine now on the market, which braids five times this quantity per day. The kind of material used for this outside covering varies; braids of cotton, jute, asbestos, silk, wool, etc., are used. In the cotton braid, there are two kinds—the soft and the glazed. The soft cotton is, as a rule, used where the braid is to be covered with a wax; the glazed, being stronger than the soft, is used on wires which are subjected to considerable handling, or where appearance is important. The glazed braid is used largely on telephone wires that are intended for inside house-wiring.

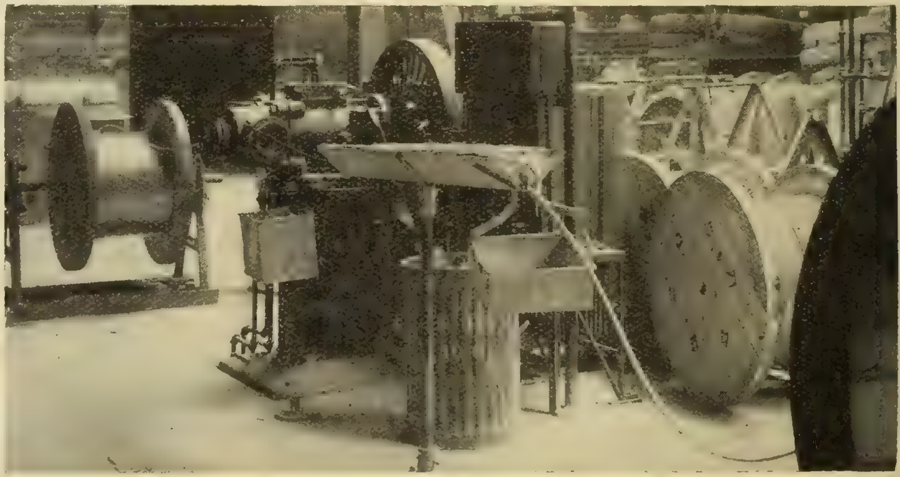

Fig. 5—Tubing machine—Wire being insulated

After the wires coming from the strip machines are braided and vulcanized, they are ready for the finishing operations. If braided with glazed cotton and there is no special treatment of the braid called for, the wire is measured, coiled and tagged, ready for inspection. The soft cotton braided wires are run through tanks containing a black insulating wax, and this, in the hot state, is absorbed by the braid, forming a covering which is waterproof and capable of taking a high polish. The wax also prevents the rapid deterioration of the cotton braid. The polishing of the waxed wire is done in a machine composed of revolving dies, which travel at a very high speed around the wire, as it is being pulled through.

After the polishing of the waxed and the coiling of the plain braided wires, the final operation before shipment is inspection. The Imperial Wire and Cable Company is a subscriber to the label service of the National Board of Fire Underwriters, and all the code wires must pass the tests prescribed by that Board before they can bear the label. The wire for this inspection is submerged in large tanks for twelve hours, and then the tests for high voltage breakdown and insulation resistance are made. A transformer of 100 kilowatts capacity and capable of producing 100,000 volts, is used for the puncture test. Besides the electrical tests there are the regular mechanical and chemical tests to be made on the rubber. To pass of the rubber must be greater than 400 the mechanical tests, the tensile strength pounds per square inch and to be sure that the rubber has been properly vulcanized, elongation and permanent set tests are prescribed. The wire is also bent around a steel spindle, and, when in this condition, must withstand a breakdown test, and the insulation must not crack. Very elaborate chemical tests must be made to determine the amount of rubber contained in the insulation. Any coils of wire failing to pass any of the electrical, mechanical or chemical tests are rejected. The representative of the National Board of Fire Underwriters oversees all tests made in the factory and, in addition, has access to the stockroom where he is free to choose coils for further check tests. By a system of inspection in the field, they are kept constantly in touch with the company's product; the Board even buys coils of wire in the field, to make check tests.

Weatherproof Wires and Cables.

Both copper and aluminum conductors are produced in very large quantities. This department is one of the largest in the company and is equipped to supply the trade with everything in weatherproof, from the smallest wire to the largest circular mill cable. Large quantities of the standard sizes are always carried in stock, so that orders can be filled promptly. The solid or stranded copper or aluminum is sent to this department usually thoroughly annealed, although in special cases, hard drawn wires are used. Two or three braids of unbleached cotton are put on in a braiding machine, similar to those described under rubber covered wire. The cotton used for the braid is thick enough for the service requirements and the strands of cotton are laid closely enough, to ensure a continuous cover in each layer. In order to make this covering weatherproof and waterproof, it is impregnated with a hot black compound, and so applied, as to fill every part of the braid. The compound used is made up in such a manner that the wire will be serviceable, both in cold and hot weather. It will not become brittle when cold, nor drip from the wire when hot. Over this filling compound, another of a more waxy nature is applied, which will take a very high polish; this is essential where the wire is to give the best service under all conditions of weather. If the wire is to be slow-burning the weatherproof compound is replaced by a fireproof compound and the finish made hard and permanent.

Paper Insulated Telephone Cable

In the manufacture of paper insulated telephone cables, the materials used consist briefly of copper manila paper, lead and tin. The processes, in order, are insulating, twisting, stranding, testing, drying-out, lead-covering, reeling and the final testing. The copper is drawn either in coils or on spools and thoroughly annealed. It is now ready for the first operation—insulating.

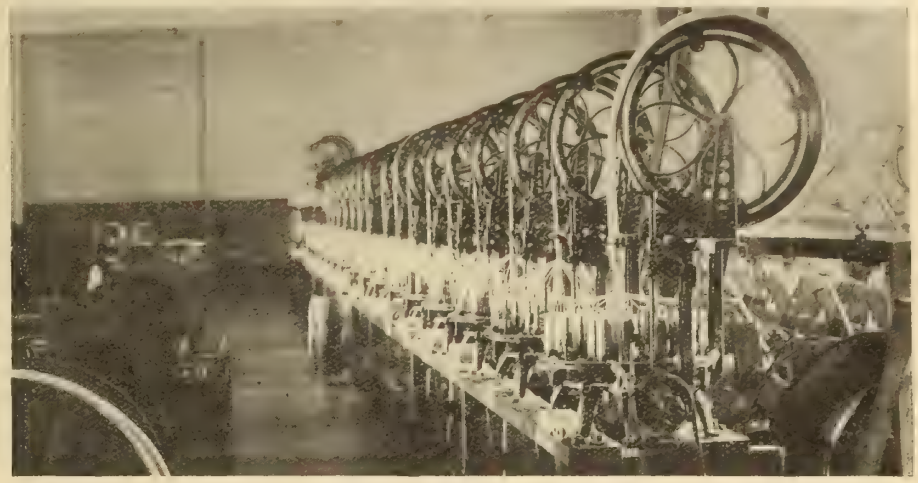

Fig. 6—Braiding machine

The paper used is the best and the most skillfully manufactured of the many kinds on the market. It must be very strong and true to gauge. Only the best manila rope fibre is used in making this paper. The finishing machine alone, employed in the production of this paper, costs one hundred thousand dollars. This will give some idea of the class of machinery necessary to produce paper of the required grade, the greater portion of which is only two and one-half one thousandths of an inch in thickness. The paper is supplied in rolls of any desired width, the pads as used on the insulating machines being made about nine inches in diameter. The insulating machine, consists of revolving heads, which hold the pad of paper and capstans, which pull the wire through and take up spools which receive the finished insulated wire. The wire passes through the center of the pad of paper and the revolving of the head puts a spiral wrap around the wire, as it is pulled through by the capstans, see Fig. 7. This is known as the American method. In the European method the paper is laid longitudinally along the wire and wrapped with cotton string. The American method is preferable, in that it allows a greater air space between the wire and the paper. The color and thickness of paper used in the insulation is determined by the size of wire and the position it is to occupy in the cable.

From the insulating machine, the wire passes on to the twisting machine. This machine is designed to twist the two separately insulated wires together to form a pair. There are several different types of twisting machines, but the underlying principle is the same in all, that is, to wrap each wire about the other, at the same time as the twisted wires are pulled off the spools at a fixed rate. One type of machine consists of a yoke which holds the spools, a capstan which draws the two wires off the spools as they revolve about an axis, and a take-up which receives the twisted wire, as it is drawn off by the capstan. Usually two differently colored insulated wires are twisted to form a pair. The length of twist is determined by the ratio of the revolutions of the yoke, to the distance the capstan travels in the same time. The majority of cables have all pairs twisted with the same number of turns per foot, but some specifications call for a certain number of pairs in a cable to have different lays from the remaining pairs. The object of having the variety of lays in the cable, is to reduce the self-induction or the "cross-talk," as the wires are less liable to be in a parallel position in the cable, if the number of twists per foot varies.

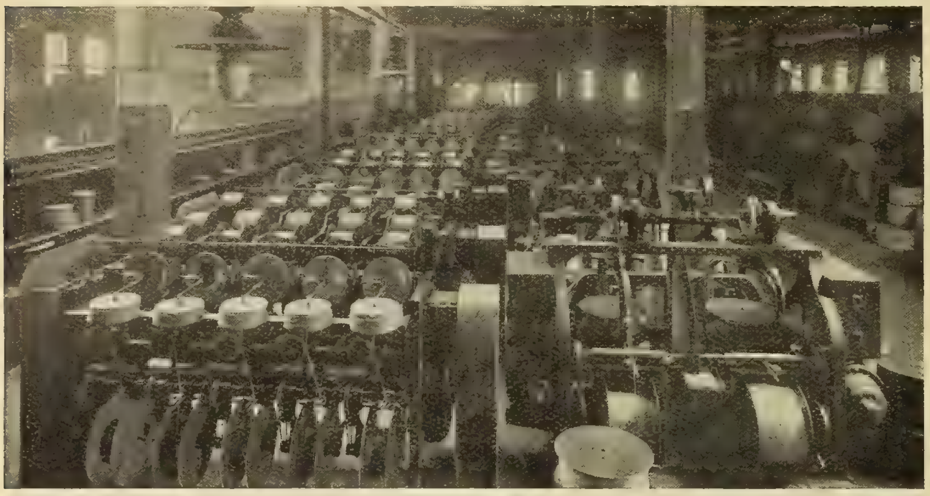
Fig. 7—Paper insulating and twisting machine

From the twisting machine the paired wires go to the stranding machine, Fig. 8. This consists of a series of drums, one behind the other, which can be revolved in either direction at any desired speed. Upon the arms of the drums, the spools of twisted wire are held. The twisted pairs are drawn first to the axis and then to the front of the smallest drum on the machine, where they are joined to the core wires that go through the machine, straight, thus forming the first layer. This drum is revolved and the bunch of wires pulled to the front end of the next larger drum ahead, where the wires from this drum are added, making the second layer. As the cable increases in size, a greater number of pairs are added in each layer. These operations are continued until the finished cable reaches the capstan and finally the take-up reel. In order to cut the cable at the length desired by the customer, one of the pairs of wires in the center is carefully measured, and a measuring machine on the front of the strander, checks this measurement. To allow for any possible defects in the cable. a number of pairs extra are made, for instance, in a four hundred pair cable, there are four extra pairs. Outside the stranded cable, two layers of heavy manilla paper are wrapped to protect the wires from the lead sheath.

After the cable is cut off from the strander and put on the reels, it is ready to be tested for faults before the lead covering is put on. The wires are tested to find any breaks in the copper wire, known as "Opens," and for "Crosses," where one wire touches another. If either defect is found, the outside paper is taken off, and the defective wire located and repairs made.

The next operation is the drying out of the cable before it is lead covered. In order to have the cables test the number of megohms required, all the moisture in the paper must be dried out. This is done in ovens heated to about 250 degrees Fah., where the cable is left for a number of hours. Readings of the oven temperature are taken periodically and recorded, to be sure no cables are lead covered which have not had their proper drying.

The machine, Fig. 9, which covers the cable with the lead sheath is very expensive and requires careful handling by trained men. Water at 6,000 pounds per square inch pressure is delivered from triple acting pumps to the water ram at the bottom of the press. The action of the water is to raise the water ram until it forces the stationary head, or lead ram, down into the cylinder containing the plastic lead. The pressure keeps on forcing the lead past the cylinder into the die block, where it is forced out of the press at right angles to its initial path. In this die block are placed, a core and a die, the core protecting the cable from the lead and forming the inside of the pipe. After one cylinder of lead has been discharged, the press is lowered, another supply of lead drawn from the lead kettle, and the same operation repeated. As the lead pipe is formed around the cable, it also carries the cable out of the press with it. In the front of the press, the lead covered cable is reeled up on the drum on which it is to be shipped. The necessary length is left out of the drum, to enable the final tests to be made. When the cable has cooled, the lead is stripped off the ends and the wires are framed out for testing. At this time, the cable is tested for insulation, capacity and conductor resistance. Test sheets are made out for every length of telephone cable, so that reference can be made at any time, to the test, should any trouble occur after leaving the factory. After the data on the test sheets has been figured and the cable found to fill the specifications in every way, the test wires are cut off at the edge of the sheath and the ends of the sheath carefully soldered up. After the protecting lags have been nailed on the drum, the cable is ready for shipment.

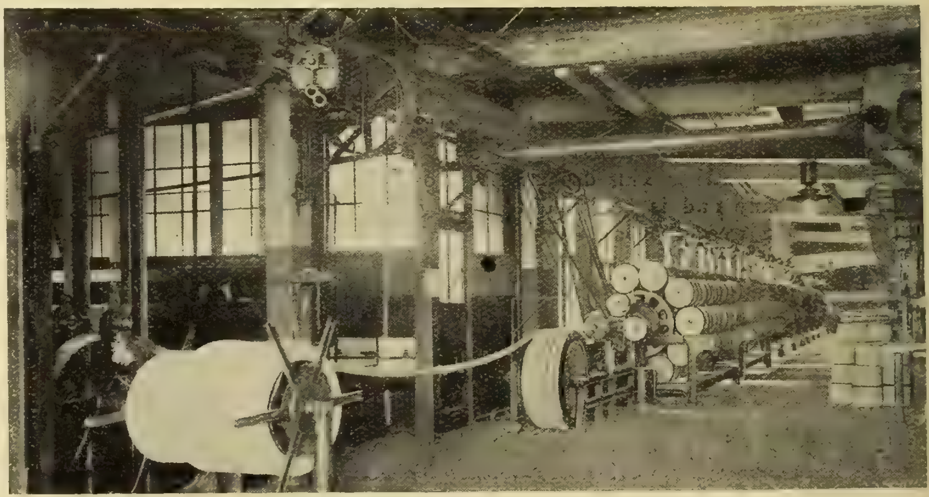
Fig. 8—Telephone stranding machine

Switchboard cable is another type manufactured by this company and used in the telephone circuit. In this, the individual wires are insulated with two winds of tussah silk and one wind of cotton, of a great variety of colors. The separately insulated conductors are paired by twisting together and then stranded into the cable in such a manner that all joining can be done by aid of a diagram and observing the colors of the wires, thus avoiding the time and expense of ringing out every wire. These cables, as a rule, are covered with a wrapping of cotton, paper, lead-tape and finally a painted braid, but in special cases, the cable is saturated in a compound and covered with a lead sheath. The treatment for removal of moisture and the electrical tests are practically the same as for telephone cable.

Paper insulated power cable is wrapped tightly with strips of paper, whereas the paper telephone cable, as previously described, is insulated loosely. This is done on the telephone cable, to reduce the electrostatic capacity as much as possible, as a low capacity means a greater talking distance over a telephone circuit. The same high grade manilla paper is used on this cable, but, as a rule, thinner strips are used on telephone cables than on power cables. In applying this paper to the copper conductor, it is important that no two edges of the paper in successive layers come together; care is taken to have the layers break joints with each other. The papers are put on, as follows:—The large pads of paper are mounted on a revolving drum, spaced uniformly along its length. The end of the conductor to be insulated is brought up to the first pad of paper; this is made fast to it, and the drum revolved, at the same time the cable is pulled through the machine, a distance equal to the width of the paper. The first paper puts a continuous layer over the conductor. When the end of the conductor comes up to the next paper, it is fastened to the first, the third paper fastened to the second, and so on, until all the papers are attached to the conductor as it is pulled at a constant speed through the machine.

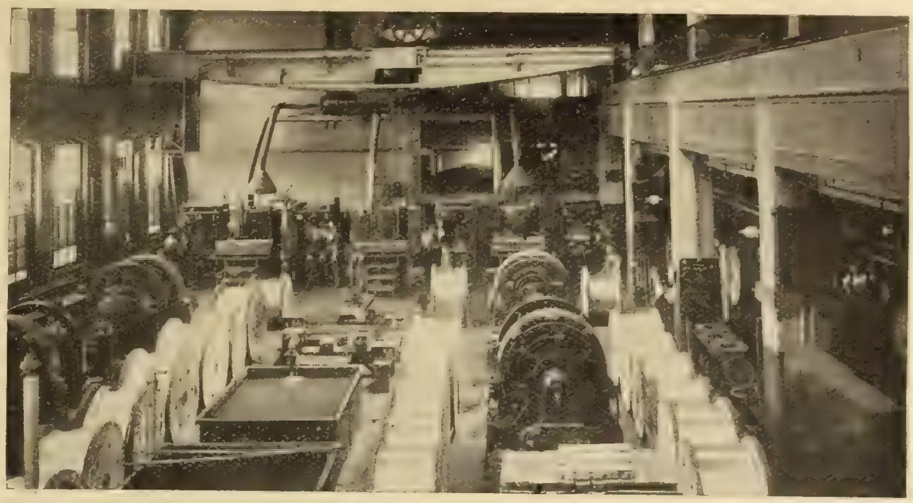

Fig. 9—Lead presses

The number of papers applied depends on the voltage to be used, and the width of the papers, on the size of the conductors. If the voltage is to be high, a thick wall of paper is put on, and if the conductor is small, narrow papers are used. Single conductor cables are made of solid or stranded copper and of circular cross section. Each conductor of a two conductor cable is usually of circular cross section, but are sometimes called for, made in "kidney" shape. in order to save space. Three conductor cables are made up of circular cross section or sector shaped single conductors. After each conductor has had the specified thickness of paper put on and a multiple conductor cable is to be made, the separately insulated conductors are stranded together and a belt of paper wound over all.

For the insulation resistance to be high and the cable to stand a high voltage, all the moisture must be taken out; this must be done before the important subsequent operation—"impregnation"—can take place. The cables are put in large tanks and the moisture taken out by producing a high vacuum, the tanks being kept at a high temperature. When this is done, the hot compound is let in on the cable and forced entirely through the paper. A lead sheath fitting tightly over the paper, is next put on, the series of electrical tests made and the cable is ready for shipment.

Magnet wire insulated with silk or cotton is an important product of this company. It is manufactured to very rigid specifications, as to limits of size, thickness of covering and finish. Cotton magnet wire is usually furnished with two coverings of very fine cotton wrapped in opposite directions, although single and triple wrap is sometimes called for; the standard for all silk magnet wire is a single covering, although comparatively small amounts are made in double or triple wrap.

In this covering for silk magnet, the very finest Italian Tram silk is used; the best long fibre combed Sea Island cotton is used in the cotton cover. The thickness of the single silk covering is about one one-thousandth of an inch, and that of single cotton two one-thousandths of an inch, and in order to get the very thin cotton coverings called for, cotton as fine as 160's is used. The wrappings of silk or cotton are applied in a specially constructed machine whose heads revolve at a very high speed. The tube of cotton is mounted on this head, and, as the wire is pulled through it by the capstan, the material is wrapped evenly, smoothly and continuously over the entire surface of the wire. After going several times around the capstan, it is taken up by the reel or spool, in which condition it is sent to the inspection department.

Switchboard and telephone cords, a great variety of flexible cords including lamp cord, counterweight, elevator light and bell, annunciator wire, etc., are manufactured and each requires its own special treatment. It is beyond the scope of this paper to go into the details of the manufacture of each of these types, the aim being to give only a general idea of the products and methods of manufacture, rather than to go too fully into detail.

Moonlight Schedule for February, 1913

Courtesy of the National Carbon Company, Cleveland.

Date.	Light.	Date.	Extinguish.	No. of Hours
Feb. 1	5 40	Feb. 2	6 30	12 50
2	5 40	3	6 30	2 50
3	5 50	4	6 30	12 40
4	5 50	5	6 30	12 40
5	5 50	6	6 20	12 30
6	5 50	7	6 20	12 30
7	5 50	8	6 20	12 30
8	5 50	9	6 20	12 30
9	5 50	10	6 20	12 30
10	6 00	11	6 20	12 20
11	9 20	12	6 20	9 00
12	10 30	13	6 20	7 50
13	11 40	14	6 10	6 30
15	0 50	15	6 10	6 20
16	2 00	16	6 10	4 10
17	3 00	17	6 10	3 10
18	3 50	18	6 10	2 20
19	No Light	19	No Light	
20	No Light	20	No Light	
21	6 10	21	8 10	2 00
22	6 10	22	10 00	3 50
23	6 10	23	10 40	4 30
24	6 10	24	11 50	5 40
25	6 10	26	1 10	7 00
26	6 20	27	2 20	8 00
27	6 20	28	3 30	9 10
28	6 20	Mar. 1	4 30	10 10

Total............215 30

Apparatus for Improving Power Factor

By Mr. Miles Walker, M.I.E.E.*

To describe all the apparatus which has been invented and developed for this purpose and for kindred purposes during the last few years would be a very great task, and it is doubtful whether one author could do justice to these new machines, intimate acquaintance with any one of which can only be possessed by the particular designer who has developed it. This paper will be confined to a short statement of the principles involved and a description of the phase-advancer built by the British Westinghouse Company.

We may look at the cause of the lagging current in the following way: The energy stored in any magnetic field consists of two factors:

(a) The total flux;

(b) The magneto-motive force driving that flux.

Now the total flux when created at a certain frequency produces a certain back e.m.f. in each turn encircling it and the magneto-motive force requires for its production a certain number of ampere-turns. Thus, from the two factors—flux and magneto-motive power—we arrive at certain factors necessary for the production of the alternating magnetic field at any given frequency. These factors are:—

1. Electromotive force per turn;
2. Number of turns;
3. Amperes per turn.

Grouping 1 and 2 together, we arrive again at two factors—volts and amperes—whose product represents the idle component of the power required to generate all the alternating fields in the distribution system.

The higher the frequency of the supply, the greater will be the idle component of the power required to produce the alternating field. If the field can be produced by a rotating magnet (as, for instance, in a synchronous motor) excited by continuous current, the frequency of the current being zero, no idle component is necessary. Indeed, by supplying more continuous current turns than are necessary to produce the magnetic field in any particular machine, it is possible to create in the system a leading current, which will compensate for a lagging current in another part of the system. The field current in the magnet of an alternator may be said to have two functions:—

1. To produce the magnetic field which generates the electro-motive force in the alternator itself.
2. To supply an additional magneto-motive force, which by means of a wattless current is communicated to all the machines in the system that have not got continuous current excitation themselves.

If we are to reduce the wattless current we must either use machinery requiring weak magnetic fields or we must provide independent means of magnetising the fields. A modern transformer does not take a large wattless component in proportion to its output, because though the total flux generated may be great, the magneto-motive force required to produce that flux is very small. An induction motor, however, having necessarily an air-gap and coils of considerable magnetic leakage, has in it a magnetic field which requires a wattless component of 25 to 30 per cent. of the kilovolt-ampere rating of the motor. For this reason the induction motor is the main cause of low power-factors on our alternating-current systems.

If now the magnetising current of an induction motor can be supplied at the frequency of the slip (say, one cycle per second) instead of at the frequency of supply (say, 50 cycles per second), the wattless magnetising kilovolt-amperes are very much reduced.

In 1895, M. Leblanc proposed to supply the magnetising current to the rotors of induction motors and generators by means of special exciters, which consisted of commutating alternating-current generators whose magnets were excited by the rotor currents.

The method can be most easily followed when applied to a rotor wound for two phases. In Fig. 1 Wa and Wb represent the windings in two phases of the rotor. Ea and Eb are the armatures of the two exciters. These exciters may be made like single-phase series motors, provided with compensating windings. The current from the phase Wa passes from the collector ring through the compensating winding Ca through the armature Ea, and then through the field Fb of the exciter in phase B, and thence to the star-point O. The current from phase Wb passes through the compensating winding Cb, through the armature Eb, and then through the field Fa of the exciter in phase A and to the star-point. The induction motor can be started up by means of the resistances Ra, Rb, the exciters being short-circuited. When the motor is running, the armature Ea has generated in it an e.m.f., which is in phase with the current in phase B; and if the polarity of the poles is properly arranged this e.m.f. will be leading 90° on the current in phase A. Similarly the armature Eb can be made to supply an e.m.f., whose phase would lead by 90° on the current in phase B. This has the effect of making the currents in the rotor take up a phase in advance of the e.m.f. produced in the rotor; so that not only can the magnetic field of the induction motor be created by the rotor currents, but the current in the stator can be made to lead on the e.m.f. of the supply. The clock diagram, Fig. 2, shows the phase relations between the various currents and the e.m.f.'s. OWa represents the e.m.f. generated in the rotor circuit by the slip. WaDa represents the e.m.f. generated in the armature of the exciter. DaCa represents the drop due to the impedance in various parts of the circuit and CaO represents the drop in the resistance of phase A of the rotor winding. The current in phase A has, of course, the phase position OCa; thus it is leading on the e.m.f. OWa, the clock diagram being supposed to be rotating in the direction indicated by the arrow. It will be seen that the line WaDa is parallel to the line OCb, because the current OCb excites the armature in phase A. Similarly the e.m.f. WbDb is parallel to the line OCa. By increasing the speed of the exciters, the e.m.f. at right angles to the current can be increased more and more. It will be seen, however, that with

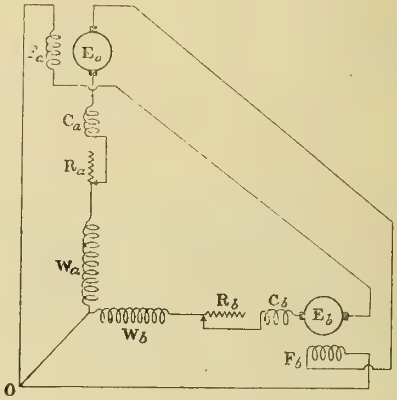

Fig. 1

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* Presented before the I.E.E.

the connections made as shown in Fig. 1, the more the rotor current leads the more acute becomes the angle DWO; i.e., the e.m.f. generated in the exciter comes to have a greater component opposing the e.m.f. generated in the rotor circuit, and this has the effect of increasing the slip of the motor.

The paper above referred to described certain experiments made with independent exciters, after the manner indicated in Fig. 1.

The main objection to the method as described in Leblanc's early patent, is that it requires two or three exciters, and as the currents to be dealt with would in general be large, the cost of these exciters becomes excessive. Leblanc has described an exciter which embodies in one machine all phases, and is of a very simple nature. This is illustrated in Figs. 3 and 4, which show two pole armatures, one arranged for 2-phase and one for 3-phase.

The armature is made like an ordinary drum-wound continous-current armature. It is surrounded by a simple ring of laminations, having inwardly projecting poles, but without any field windings. The notches in the field are to aid commutation. If such an armature as illustrated in Fig. 3, be provided with four brushes, placed at 90° to one another on the commutator and connected to the four slip rings of a 2-phase rotor of an induction motor, and is run at a speed which is high as compared with the frequency in the rotor circuits it will have the effect of producing leading currents in the rotor. The beauty of this exciter is that the armature currents themselves excite the field, and produce a flux in the armature which is in such a phase as to generate an e.m.f. in each circuit, exactly at right angles to the current carried by that circuit. For, at the instant when the maximum current is going into the armature by brush A_1, and out at brush A_2, the armature will be magnetised with one pole at the top and another pole at the bottom, so that no e.m.f. is generated in phase A, but a maximum e.m.f. is generated in phase B. Thus we see that the e.m.f. in any phase is always at right angles to the current in that phase. The question whether the e.m.f. leads or lags behind the current depends only on the direction of rotation. Such an exciter can be built for three phases as illustrated in Fig. 4, and would be much cheaper to build than three separate exciters. By proper design, and by using carbon brushes, the commutation can be made sufficiently good; but in view of the fact that the rotors of induction motors of large power usually carry very heavy currents, the commutator of such an exciter say, for a 1,000 h.p. motor, would be of considerable dimensions.

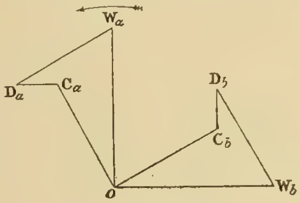


Fig. 2

A. Scherbius, in a recent letter to the Electrician, gave an illustration of a phase-advancer of this type made by Messrs. Brown, Boveri & Company, capable of bringing to unity power-factor a 600 h.p. motor. The overall dimensions of this set are 50 inches by 22 inches by 25 inches, and its weight 750 lbs. The cos curves of a 400 h.p. 32-cycle motor running at 160 revs. per minute both with and without the advancer are given in Fig. 5.

It will be recognised that the stationary iron frames in Figs. 3 and 4 are not really necessary, except in so far as they may reduce the magnetic reluctance of the magnetic circuit when an open slot-winding is used on the armature. If a winding with closed slots is used, the magnetic circuit may lie wholly within the armature. While the armature rotates, the field remains stationary as long as a continuous current is supplied to one set of brushes. If currents slowly alternating, such as those from a rotor winding, are supplied, the field slowly revolves in space while the rapidly revolving armature conductors cut across this field and generate the necessary leading electromotive forces. An exciter of this kind having no external field, and made by Messrs. Brown, Boveri & Company, was recently illustrated in the Electrician. The use of the external frame, however, seems to possess several advantages; it enables open slots to be used on the armature, and by fixing the position of the field independently of the currents carried by the armature enables the commutation to be performed in a thoroughly satisfactory manner.

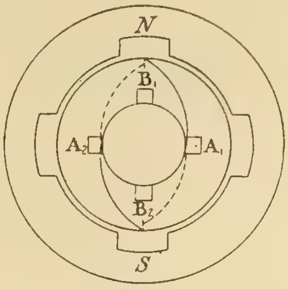


Fig 3.

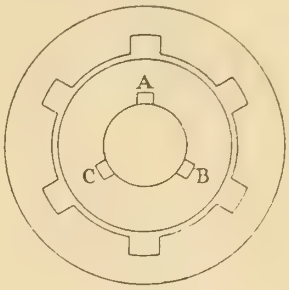


Fig 4

It should be pointed out that the main reason why the phase-advancer has a fair chance of commercial success is that it is a machine of small output in comparison with the amount of change of wattless load which it is capable of effecting when used in conjunction with an induction motor of suitable size. A phase-advancer of only 30-kv.a. capacity is capable of changing the power-factor of a 1,300 k.v.a. motor from 0.88 lagging to 0.95 leading. That is to say, the motor instead of requiring to be fed with lagging wattless current to the amount of 600 k.v.a. will relieve the generators supplying the system of a wattless load of 400 k.v.a., making a total change in the wattless power of 1,000 k.v.a. to the good. The reason is that the phase-advancer stands in the same relation to an induction motor as an exciter does to a synchronous motor. An exciter of comparatively small capacity can over-excite a synchronous motor so as to make it supply a wattless load fifty times as great, measured in k.v.a., as the rating of the exciter. Now if for some mechanical work a large induction motor must be employed, the extra cost of making that motor run at unity, or even at a leading, power-factor is not very great. It is merely a question as to the cost of an advancer whose rated output is some 3 to 6 per cent. of the rating of the motor, and the cost of a 3-phase double throw switch for putting it in and out.

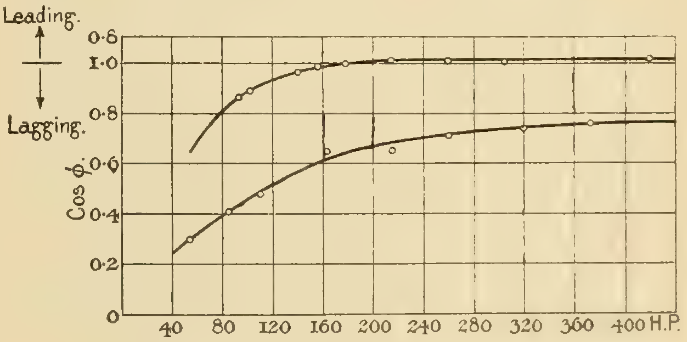


Fig 5

The armature of the phase-advancer may either be of the open-circuit star type or of the closed circuit type. Both kinds of armature commutate well. The first (Fig. 6) is suitable when the current to be collected on the commutator is very great and the voltage to be generated is small, say not more than 15 volts. It enables a very wide brush (extending over 0.7 of the pole pitch) to be used. The second

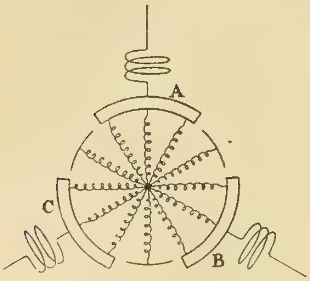


Fig 6

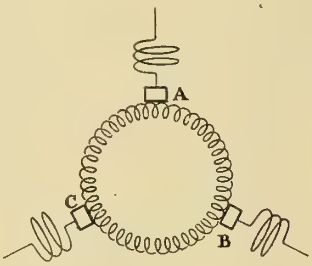


Fig 7

type (Fig. 7) is suitable when the current is not very great and the voltage is higher.

In designing the rotor of an induction motor we have a fairly free hand in the choice of the standstill voltage. We may choose a low voltage and a large current, or a higher voltage and a smaller current. It is usual even on very large motors to keep the standstill voltage below 1,000 volts so as to avoid excessive stresses on the insulation; but it is probable that if phase-advancers are much used in the future the standstill voltage of the rotors of very large motors will be somewhat increased. There is no difficulty in insulating the revolving winding to withstand considerably higher voltages particularly as the running voltage is exceedingly low.

The cases that will be found most suitable for the addition of phase-advancers to induction motors are those where the motors are intended to run continuously in one direction throughout the greater part of the day. If a motor is intended to be started and stopped frequently, or reversed, then it is not suitable. Large induction motor-generators, whether the continuous current load is steady or not, might very well be fitted with phase-advancers to improve the power-factor of the system to which they are connected; also large induction motors driving fans for mines or driving other machinery which runs continuously in one direction.

(Concluded in February 15th issue)

Report on Underwriters' Laboratories

Their Formation, Scope of Operations and Effect on the Importation of British Goods into the Dominion of Canada

By Mr. C. Hamilton Wickes

The U. L. C. is located in a specially-designed building at 207 East Ohio Street, Chicago, Ill., with a plant and equipment valued at £20,000. It was granted a charter in November, 1901. The U. L. C. has one Branch Testing Laboratory (recently erected) at New York.

The establishment of the Underwriters' Laboratories, Chicago, was brought about doubtless by the great and disproportionate destruction of property by fire throughout the United States, and in consequence of the heavy losses that resulted, which fell on the insurance companies (fire underwriters).

It should be understood that the problem the insurance companies had to solve, in view of the conditions prevailing throughout the United States, and it may be said North America, was to evolve some method which would tend to reduce the great danger existing of fire hazard and the consequent restriction of business. Among other difficulties appertaining to the position differing from the United Kingdom was:—(a) The common use of wooden buildings; (b) the great area of the territory; (c) the high voltage of the electric current transmitted by overhead wires, even through the main streets of their cities; (d) the large number of manufacturers, good, indifferent and bad, intent only on selling their products, in many instances to firms with little or no technical knowledge, who styled themselves contractors, architects, etc.; (e) the compelled employment of careless, indifferent and incompetent workmen; (f) together with the practical impossibility of obtaining anything like skilled inspection or supervision of the work, even in the towns.

To use the phraseology of "The National Board of Fire Underwriters (New York)," "it was found necessary to provide means for securing a correct solution of the problems presented by reason of the great and disproportionate losses by fire, and to bring to the 'user' the one best obtainable opinion on the merits or demerits of appliances in respect of fire hazard."

This is a high and proper ideal, but however great the necessity might have been for an institution of this character, that would not in itself necessarily have brought about the inception, nor given the U. L., Chicago, the power, and, practically, the absolute control, it exercises to-day over all articles, appliances, material or devices styled "articles for public utility," affecting fire hazard used in buildings throughout the country. It is due to the hearty support which came to be accorded as the value of the Laboratories' work became recognized by the insurance companies—British, American, German, French and Canadian—carrying on business in the North American Continent.

The Laboratories had quite a humble beginning, and I am informed that at the first they confined their attention to certain classes of electric material and fittings, e.g., the "National Electric Code" standards were first compiled in 1896-7 but their influence has steadily grown and they cover to-day (inter alia):—

(a) Machines and fittings which may be instrumental in carrying a fire, gas and oil appliances, electric fittings, wiring, conduits, fuses, etc. Machines and appurtenances used in lighting or heating chemicals.

(b) Fire extinguishers, automatic sprinklers, pumps, hand fire appliances, hose, hydrants, nozzles, valves, etc.

(c) Material and devices designed to retard spread of fire, structural methods and materials, fire doors and shutters, fire windows, etc.

President of the Corporation, chairman of the Board, Mr. Henry C. Eddy, of Chicago (resident secretary, Commercial Union Assurance Company, and the Palatine Insurance Company); secretary and treasurer, Mr. Wm. H. Merrill, Chicago. The board of directors consists of 10 other gentlemen, of whom four represent British companies, and six American insurance companies.

There are, therefore, including the two British insurance companies represented by the president, six British and six American companies represented on the Board of the U.L.C.

The board constitutes the governing authority, handles its finances, and directs all matters of policy, including appointment of "the Council," the manager and members of the engineering staff.

Technical Staff of Laboratories

The manager is Mr. W. H. Merrill; the chief engineer, Mr. W. C. Robinson (who recently visited England), and there is a staff of over 50, which includes consulting, electrical, gas and oil, and chemical engineers, with numerous assistant engineers, a superintendent of labels, cashier, etc.

The Council

A body having important functions connected with the U. L. C. is the "Council." The members are nominated by the "board of directors of the laboratories," as stated above. The Council consists of gentlemen who, either in their individual or corporate capacity, have the requisite knowledge or employ technical men on their staff, able to advise them in respect of the Reports forwarded for their consideration by the Underwriters' Laboratories. It will be noted that among the members of the council are Mr. W. H. Merrill, manager of the Laboratories, Mr. W. C. Robinson, his chief engineer, and Mr. Hadrill, who, as secretary to the Canadian Fire Underwriters' Association, has under him quite a number of technical men.

It is by the Council that the technical work at the Laboratories is supervised, and it is not until the Reports are approved by the Council that they are promulgated. The Council numbers 22.

The technical staff, having carried out the experimental work and tested the merits or demerits of each article, device, appliance, material or system submitted, with a view to their bearing upon fire hazard, proceed to draw up a detailed and extremely elaborate report. This report is forwarded to each member of the Council, and in due course is returned to the Laboratories with such endorsements, amendments or criticism as each member of the Council may consider necessary or advisable. The points raised, if any, are then printed and again circulated to all the members until a decision has been obtained. The final decision, whether favourable or otherwise to the article, device, appliance, material or system, is bulletined, that is, a summary of the Laboratories' Report is distributed on printed cards, filed, according to classification, to the various insurance organizations and companies subscribing to or co-operating with the Laboratories' work. A copy of the bulletin (printed card, presumably) and the detailed report is furnished to the applicant, who originally submitted the article for inspection.

There can be no doubt that the greatest care is taken in the experimental work and tests carried out by the Laboratories, and equal care in the preparation of the Reports in its final shape before any article, appliance, material, device or system receives the final approval of the U.L.C.

It may be observed here that cabinets containing these cards are maintained at the offices of the principal Boards of Underwriters and inspection bureaus in the United States and Canada and a few in other countries, at many of the general offices of insurance companies, certain municipal departments, and at the local offices of the Laboratories in the larger cities. There are also "lists" compiled by the Laboratories, which are freely distributed, of "approved and permitted devices," with the manufacturer's name.

Specifications, Rules and Requirements Under Which the Experimental Work is Carried on at the Laboratories

The specifications under which the experimental work is carried on by the technical staff of the U.L.C. are based upon the rules and requirements of the National Board of Fire Underwriters, New York, as "recommended by the National Fire Protection Association, New York." This is the present practice; previously the various Committees acted solely under the direction of insurance authorities. These have been transferred to the National Fire Protection Associations, in which "all interests are represented."

Many of "The Rules and Requirements" referred to above are printed in pamphlet form. Printed copies of these pamphlets are filed with the Board of Trade.

Inspection at Manufacturers' Factories and Labelling

The article, appliance, device, material or system submitted to the U.L.C. having been tested and approved, the Laboratories step in and say, "before the article may be marketed it must come under our supervision before we will issue a label or tab to indicate that the same has been inspected and passed by us."

The older form of supervision is: A contract to be entered into between the manufacturer and the U.L.C. whereby the maker agrees to construct appliances in exact duplicate of the sample approved, and to pay a certain fee annually, ranging from $5 to $30.

The second or newer form of supervision consists in inspection by Laboratory engineers of the devices and materials at factories, and the labelling of standard goods by stamps, transfers, or metal labels, whereby they can be recognised wherever found. The cost of the service is partially defrayed by charges made for the labels. These vary according to the nature and extent of the inspection needed.

A "schedule" of the charges for labelling certain "standard goods" will be found, as a guide, in Appendix "F," together with specimen lithographed labels. The sale of these labels includes the following costs:—

1. Cost of manufacturing the label.
2. Salaries and expenses of agents and inspectors of branch offices.
3. Salary of supervising engineer at home office.
4. Salary and travelling expenses of special agent.
5. Overhead charges.

Inspection

Throughout the United States the U.L.C. has officers who inspect and pass articles, appliances, devices, material or the system installed in any building which the owner requires to insure. It is these inspectors who accept or refuse articles because they have not the U.L.C. label or tab. So far as the Dominion of Canada is concerned, the inspectors are appointed by the Canadian Fire Underwriters' Association. The contention is that the inspection departments of insurance organisations find it easier to pass upon an installation in which nothing but labelled material is used—and this it is contended tends to a better class of installation.

It should not be inferred that the inspector's duty is confined to checking the labelled material. It is important from the manufacturer's point of view, but from the insurance companies' standpoint the inspector has to see that the workmanship of the wireman and electrician, for example, is good, and that the work has been carried out in accordance with the Rules and Regulations dealing with the design and layout of the installation. Generally, his skill in judgment and experience is called for in interpreting these rules and requirements in accordance with the particular kind of building which he is inspecting for the time being.

An important factor is the question of danger to life "should a fire occur." This, I fear, is not taken into account. In fact, I understand it cannot come within the inspector's consideration, so long as the installation complies with safeguarding fire hazard.

Cost of Experiments and Tests, with Some Particulars to Intending Applicants.

Blank forms for use in making applications for tests will be furnished on request to the U.L.C., 207 East Ohio street, Chicago, although no fixed form of application is necessary. A letter addressed to the Laboratories, setting forth all the claims made for the article, enclosing the preliminary fee, and giving notice of shipment, is sufficient. All shipments should be consigned to Underwriters' Laboratories (Inc.), 207 East Ohio street, Chicago. The latter are not responsible for damage in shipment, and cannot undertake to repair damaged goods, or to assemble or erect apparatus shipped in parts.

Freight or express charges must be prepaid.

Goods from the United Kingdom should be shipped in bond.

It is understood that Customs charges, if any, are paid by the Laboratories.

It will be noted in the particulars given below that in respect of articles coming within Groups A to E, there is "a maximum" cost, which will not, under any circumstances, be exceeded.

The Laboratories will, on receipt of an application accompanied by description of the article to be tested, advise as to necessary charges in each case, and in all instances where the costs do not aggregate the amount of the preliminary fees, the balance will be returned to the applicant, to whom, at the conclusion of the "test," a full and detailed account is rendered, and, as stated above, a copy supplied of the Bulletin, as well as the detailed Report. The fees are as follows:—

Group	A.	Preliminary fee,	$100.00	Total cost not to exceed	$250
"	B.	" "	50.00	" " "	10
"	C.	" "	25.00	" " "	7
"	D.	" "	10.00	" " "	5
"	E.	" "	5.00	" " "	2

Group F.—Under this group are classified experimental work and researches covering subjects or appliances for which standard requirements are not accepted. The amount of preliminary fee is $100, and bills are rendered monthly as the work proceeds.

The various articles, appliances, materials, devices and systems thus far tested (1909), are classified into the various Groups A to E.

General Remarks

The parent body of the Underwriters' Laboratories, Chicago, is "the National Board of Fire Underwriters, New York," under whose "general direction" the work at the Laboratories is carried on. In practice, however, the power of the parent body may be said to be vested in The Board of Directors. The chief financial support is derived from the parent body, the Laboratories not being in business for profit; it is not believed that it has made any profit; the U.L.C. is a corporation for fire protection and not for profit. The insurance companies are the largest contributors. They receive regular appropriations from the National Board of Fire Underwriters, the Western Insurance Union, and other organisations, as well as from a number of individual companies who desire special service in the matter of reports.

It will be noted in going through the Report that the Rules and Requirements are adopted by the N.B. of F.U. (N.Y.) under the recommendation of the "National Fire Protection Asociation, of New York." This important Association, whose president for the year 1912-13 is Mr. H. L. Phillips, of 5 Haynes street, Hartford, Conn.; vice-president, Mr. G. M. Robertson, of San Francisco; and secretary-treasurer, Mr. F. H. Wentworth, 87 Milk street, Boston; with a chairman and executive committee of 15 gentlemen, five of whom retire yearly, dates from the year 1896-7, about which time a "National Conference" was held at New York.

Standard electrical rules were drawn up as the result of the united efforts of the various insurance electrical, architectural and allied interests; the National Conference was disbanded, the work (of the Underwriters' National Electrical Association and of the National Conference) being taken over by the National Fire Protection Association. The following Associations, formerly members of the National Conference, are represented on the Electrical Committee of the N.F.P.A.:—

American Electric Railway Association.
American Institute of Electrical Engineers.
Associated Factory Mutual Fire Insurance Company.
National Board of Fire Underwriters.
National Electric Light Association.
National Electric Contractors' Association.
National Electrical Inspection Association.

The work of the National Fire Protection Association, of New York, is directed by Special Committees, of which there are no less than 29, and covers subjects as wide apart as "safe and vaults" and "hose," "electric railway, light and power properties," "automatic sprinklers," "fire pumps," "gravity tanks," "mine fires," "laws and ordinances," "signalling systems,", etc.

The report of proceedings of the sixteenth annual meeting held at Chicago, May 14th, 15th and 16th, 1912, accompanies this report, and The Year-Book of the National Fire Protection Association (September, 1912) gives the membership, from which further detailed particulars can be ascertained.

The membership of the N.F.P.A. consists of four classes: Active, who only have the power to vote—membership 102, with a subscription of $15 per annum; Associate, over 1,200 members, annual subscription $5; Subscribing, over 600 members, annual subscription $5; Honorary, 3 life members.

The Active class comprises 102 members, including (1) National Institutes, Societies and Associations interested in the protection of life and property against loss by fire, (2) State Asociations, whose principal object is the reduction of fire waste, (3) Insurance Bodies and Insurance Associations having primary jurisdiction. Out of these 102 Active class members 82 are Insurance Companies (fire underwriters) or Associations connected therewith, such as inspection bureaus, actuarial bureaus, etc. Twenty may be styled business associations. Among the latter are the following:—

American Institute of Electrical Engineers, New York.
American Institute of Consulting Engineers, New York.
American Electric Railway Association, New York.
American Institute of Architects.
American Warehousemen's Association, Pittsburg.
Canadian Manufacturers' Association.
Electrical Supply Jobbers Association, Chicago.
National Association of Manufacturers, New York.
National Hardware Association, Philadelphia.
National Paint, Oil and Varnish Association, New York.
National Electric Light Association, New York.
National Electrical Contractors' Association, Utica, New York.
National Association of Sheet Metal Contractors Philadelphia.
Canadian Fire Underwriters' Association, Montreal and Toronto.
Mainland Fire Underwriters' Association, Vancouver, B.C.
New Brunswick Board of Fire Underwriters, St. John, N.B.
Nova Scotia Board of Underwriters, Halifax, N.S.
Western Canada Fire Underwriters' Association, Winnipeg.

Canadian Fire Underwriters' Association

Offices, 535 Coristine Building, Montreal. Secretary, Mr. A. W. Hadrill. At the present time 60 insurance companies are members of this Association. I might mention that while this is by far the most important of the Underwriters' Associations in the Dominion of Canada, there are four others, as stated above.

Of the present list of 60 members of the Canadian Fire Underwriters' Association 28 are British, or their capital is controlled in Great Britain, 19 are American, 12 Canadian, 1 French.

The British insurance companies—headed by the Royal Insurance Company—together underwrite some 55 per cent. of the total fire risks in the Dominion of Canada, and therefore occupy an important position in the Associations of Fire Underwriters throughout Canada. Their position and influence in the United States of America are also considerable.

British Manufacturers v. The Operations of the Underwriters' Laboratories, Chicago

The experimental work carried out by the Laboratories at Chicago, their method of drawing up reports and labelling approved articles, followed by inspection, already dealt with, is no doubt advantageous, not only to the fire insurance companies, but also to the American manufacturer carrying on business in the United States. I would also be prepared to concede that the U.L.C. are desirous of not placing difficulties in the way of the foreign manufacturer (which includes British) utilising the facilities offered by them. It is nevertheless an intolerable state of affairs that the British manufacturers, as well as the Canadian, should be compelled to send samples and particulars of their goods to a foreign corporation, to be "approved or rejected," before they are able or permitted to do business in a portion of the British Empire, namely, the Dominion of Canada.

I will briefly outline some of the more salient points which operate to the disadvantage of the British manufacturer desiring to do business in the Dominion:—

1. The British manufacturer has to incur the expense of packing and freighting the articles forwarded to the Laboratories at Chicago, with the consequent delay. Whether the article is approved or otherwise, he is still unable to ship the goods to the Dominion, as no means exist of examination and labelling at the factory in the United Kingdom, which the Laboratories properly insist on.

The suggestion has been put forward that such goods shipped to Canada might be examined and labelled, as the Laboratories require, at "the port of discharge" in the Dominion. The objection to this course is that besides the expense of maintaining a qualified inspector, there is a real risk incurred of the goods not being passed (rightly or wrongly), with consequent loss to the British shipper, in all probability followed by the return of the goods to the United Kingdom, with the great expense thereby entailed.

2. The Laboratories are officered by consulting and other engineers expert in regard to various lines, as has been shown. It may be conceded that they exercise a wise and discriminating care in the carrying out of their duties in regard to American manufacturers, but when it comes to experimenting and testing articles of British or European manufacture, devised on different lines and manufactured to standards other than the rules, requirements or standards laid down by the N.F.P.A., under which the Laboratories carry out their work, the technical staff, without any experience in regard to the reliability of the article submitted in actual use, not infrequently find themselves obliged to withhold their authorisation. To this the British manufacturer very properly objects, and he feels the more indignant when he is aware that his manufactures in every way meet the more stringent requirements in other parts of the world. I think he should be supported in this objection unless, indeed, we are prepared to concede that the United States engineer is the repository of all the wisdom of the world in regard to every class of article, appliance, system or device dealing with fire hazard, which has been, or is to be, invented in the world.

3. The System of Inspection amounts, in practice, to the inspectors appointed seeing that certain labels or tabs are appended to articles. In time, no doubt, they become more or less experienced, but the idea is to throw the responsibility of the real inspection of the article on the Laboratories at Chicago. The inspector is, apparently, expected to work on rule-of-thumb lines. He is, I gather, not expected to do otherwise than see that labels or tabs of the U.L.C. are properly attached to the article, device or system to be installed in the various buildings.

The tendency is for this attitude to become accentuated; pressure has been, and is being, exercised by the Laboratories on the Canadian Fire Underwriters Association not to allow any article to be installed, within their jurisdiction, without the Laboratories' label or tab. In Winnipeg the use of the Laboratories' label has been made the rule by the Western Canadian Fire Underwriters' Association. In Montreal they have been, I am informed, not quite so strict up to the present, but Mr. Hadrill, secretary of the Canadian Fire Underwriters' Association, confesses that their inclination is to draw the line tighter and only permit goods with the label or tab of the U.L.C. to be utilised.

I might mention in this connection that complaints, difficult to prove or disprove, are made by British manufacturers or their representatives of prejudice on the part of inspectors against British goods, and of the necessity, as they allege, of gaining the inspector's goodwill by means of a douceur in order to facilitate the passing of material submitted. This difficulty is probably in respect of articles without the customary Laboratories' label or tab.

I would refer to what has been stated before, and that is, that the Inspector's skill and judgment is called for in regard to the application of the Rules and Requirements, for example, the workmanship of the wireman or electrician generally regarding the design and lay-out of the installation, taking into consideration the particular kind of building in which the work is being carried out.

I would also repeat that I understand there are no regulations to guide the Inspector with reference to "danger to life" in the event of fire breaking out; in other words, that the wiring and other matters which he inspects are looked at purely and only from the point of view of fire hazard to the building, without regard to the matter of hazard against life (shock fatality, and so forth).

4. It will be readily recognised in view of manufacturing and other Mercantile Associations which are "active" members of the N.F.P.A. and the American composition of the Council, and the experience practically based on American practice, so far as I know it, of the technical staff of the Laboratories, that the introduction of new methods or fresh standards might meet with considerable opposition, and, in addition, there would probably be a natural reluctance to give a definite finding in respect of articles which may be practically unknown either in respect of their form or in regard to their reliability.

5. It should be mentioned that particulars are filed in this office of instances in which the parties alleged discrimination and unfair treatment, in respect of both electrical and other classes of goods submitted to the Laboratories. Personally, I find it hard to believe that any discrimination has been shown beyond what may be easily explained by the composition of the Laboratories, the council and the associations under whose direction the work is carried on. An incident which happened in Montreal in August last illustrates another phase of the difficulty met with by British goods sent to Canada. A sample of wire was sent to the Chief Electrical Inspector in Montreal, and I have a copy of his letter in which he stated, "the samples of wires enclosed are acceptable." In Toronto the following month, in regard to the same article, I have a copy of the original letter from the Chief Electrical Inspector, in which he writes as follows:—"We beg to advise that neither of the two pieces comply with new code requirements." Of course, in the

latter instance, the reason was that the wires were not labelled and tabbed with Laboratory labels.

The above is a sample of a number of similar instances which it can be readily understood cause considerable heartburning to the parties injured, particularly where the goods are of high class, and, in fact, manufactured to a much higher standard than is required by the Laboratories themselves. Nevertheless, the inspector must reject them in many parts of Canada if they have not evidence of the approval of the U.L.C.

The chief engineer of the U.L.C. was in England as recently as August-September last, and saw the managers and representatives of a number of British insurance companies while staying in London—Mr. Robinson having also visited Manchester, Liverpool and Birmingham, in accordance with Mr. Merrill's desire that he should endeavour to ascertain the attitude of English manufacturers towards the Underwriter's Laboratories. I will close my remarks on this heading by an extract from a letter from Mr. Robinson, after his visit to England, to Mr. Merrill, manager of the U.L.C., Chicago:—

"As a result of all my conferences in England with manufacturers, insurance men, and others, I am of the belief that in a considerable number of cases English manufacturers will be likely to object to sending their products to any authority in the United States in order to secure insurance approvals for Canada.

"The following was presented for the consideration of the Insurance Managers, and was discussed to some extent:—

"1. The possible desirability of in some way establishing the Underwriters' Laboratories in England in order to facilitate its business with English manufacturers and avoid misunderstandings relative to the approval of goods shipped into the United States and Canada.

"2. The question of what connections could be made and the best method for the conduct of the business in case it was considered desirable to establish the Underwriters' Laboratories in England."

"I am of the opinion that there is a genuine desire on this side, both by the Canadian Fire Underwriters' Association and the U.L.C., to remove any cause for complaint which the British manufacturer labours under, but the insurance companies are not going (I think rightly) to permit uninspected goods to enter and be used from the U.K. or elsewhere, because they consider the risk is too great; an alternative method, therefore, safeguarding the insurance companies operating in Canada, should be evolved. The solution might be by—

"1. A laboratory in Canada on the lines of the U.L.C.

"2. A purely British laboratory, referred to at the end of Mr. Robinson's letter as 'an independent agency.'

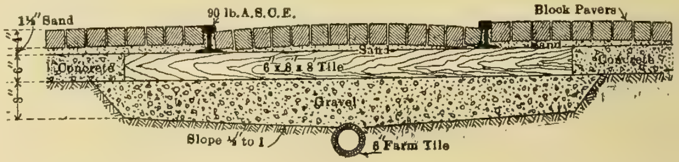
"3. A laboratory in England, to be practically an offshoot of the U.L. Chicago—run on similar lines, utilising the experience gained at Chicago, employing equally competent but British consulting and technical engineers. 'The article,' approved by label or tab, to be accepted by both the British and Chicago Laboratories. The same system of careful experiment and tests to be followed by careful consideration of reports before they are issued, and the adoption of the same or a similar system of 'labelling and tabs,' accompanied by some similar system of inspection.

"I am of the opinion that the last, No.3, would be to the advantage of the British manufacturer (No. 1 is open to many of the objections raised against the Chicago Laboratories); it would throw open to our British manufacturers not only the Canadian but the American market (see Mr. Robinson's letter), as the labels or tabs would carry equal consideration by inspectors throughout North America. Moreover, the policy should be extended, I believe, and made operative in Australia, New Zealand, South Africa, India—in fact, throughout the Empire, wherever British insurance companies operate and are in a position to insist on its adoption."

I venture to believe that, if our leading manufacturers are wise, they will join with the insurance companies and contribute towards the initial cost of starting such a laboratory and by annual subscription assist towards its upkeep. An understanding between our manufacturers on the one hand, and the insurance companies on the other, should lead to the happiest results. It should bring about the extension of the trade to British manufacturers of articles, appliances, materials, devices or systems dealing with fire hazard in the oversea markets, and be of advantage to British insurance companies in the direction of reducing the risks of "fire hazard."

New Type of Track Construction

The Illinois Traction Company has recently developed a type of track construction in pavements which includes several novel features and which are described in a current issue of the Electric Railway Journal. A section of this new construction is shown in the illustration. It was designed for both creosoted block and brick pavement and its advantages are found in the method of handling the pavement between the tee-rails. The section was designed for 90 lb. A.S.C.E. rails on 6-in. x 8-in. x 8-ft. wooden ties with a 6-in. concrete foundation under the pavement. By employing a template, a sand cushion, as shown, is formed between the rails and gives a crown at the centre equal to the height of the ball of the rail, so that no special filler block in the pavement is required. In case brick is used, a special brick may be purchased which is 3-in. deep, or the paving block, if the width is less than the depth, may be placed on its side. In case a creosoted block is used, the shallow block may be purchased at no additional cost over the price of the standard size; this is the cheaper method of paving between the rails.



Another feature is the method of preparing the sub-grade. Usually the trench containing the ballast under the ties is rectangular in section, but in this case in order to provide drainage to a 6-in. tile, shown in the figure, which is installed at the centre of the trench, the sub-grade is sloped from the ends of the ties to the tile, ½-in. to 1-ft. The installation of farm drain tile with outlets in the centre of the track trench is advantageous in that the trench is usually below the sub-grade of the street.

Current Notes

The city of Moose Jaw will receive tenders for electrical machinery up to Monday, February 10th, for the manufacture, supply, delivery and erection of a 1,500 kw. steam turbine and generator. Specifications and general conditions may be obtained upon application to Electrical Superintendent Peters at Moose Jaw.

The municipality of the city of Regina, Sask., will receive tenders for track and trolley material for the Regina municipal railway system up to Monday, February 24th. Copies of specifications, schedules, delivery dates, form of contract and other particulars can be had upon application to H. Doughty, superintendent of the Regina municipal railway. Details of material required will be found in an advertisement appearing in another page of this issue.

ELECTRIC RAILWAYS

New Type Cars of the B. C. E. R. Co. — Both Stepless and Nearside Being Tried Out.

The British Columbia Electric Railway Company, have recently introduced a number of ideas, new to Canada in the way of rolling stock and accessories. The company have recently purchased, for experimental purposes, a "stepless" car similar to the well-known New York type and a "nearside" car, similar to those operated by the Philadelphia Rapid Transit Company. Though both double and single end prepayment cars are the standard type on the city lines of this company, the new designs were purchased to ascertain their relative merits and their adaptibility to Vancouver conditions.

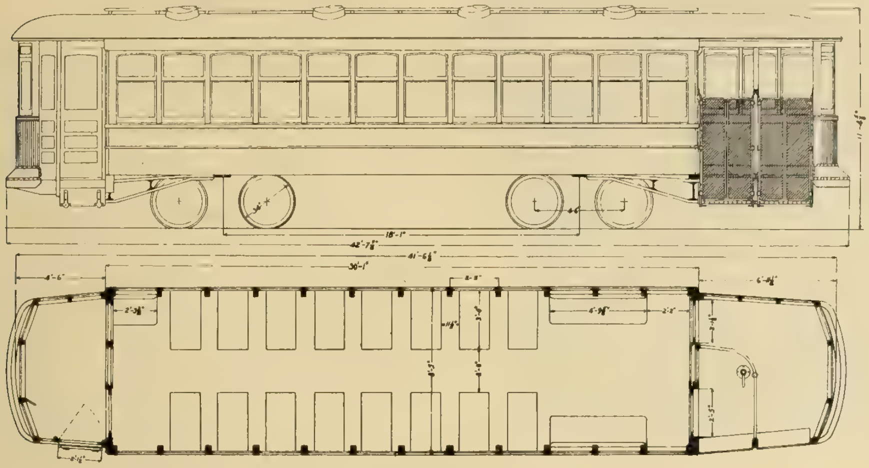


Fig. 1

Wire-mesh Gates

The line sketch shown herewith, Fig. 1, also illustrates another new idea, the folding wire-mesh gates installed on the rear platform of a number of the cars. The rear platform is divided by a railing, for separate entrance and exit, that extends from the bulkhead to a wooden post placed at the centre of the step and reaching to the hood. Two pairs of wire-mesh gates are hinged to this post and to the body and vestibule posts. They swing outwards and are operated by a simple lever system from the conductor's position. The front platform of this car, which is used for exit only, is provided with a folding step and inwardly swinging door operated in unison by the motorman, through a lever.

The "Nearside" Car

The "nearside" car is in every way a counterpart of those that have been adopted as standard by the Philadelphia Rapid Transit Company. It differs only in that it is arranged for left instead of right-hand operation, the former being standard on the B.C.E.R. lines.

The bottom frame, which is built entirely of steel, has side sills of 5-16-inch plate, 18 inches at the widest part, reinforced at top and bottom and vertically, at intervals, by light angles. At the forward end, upper trusses assist the knees in supporting the long platform. There are eight crossings made of light angles, forming powerful latticed trusses. The body bolsters are cast steel and are each designed to carry 21,000 lbs. at the center plate. The side posts, which are of ash, are tenoned into a yellow pine sill that is bolted to the lower angle on the sill plate. They are further secured by strap bolts that extend through the pine sill and angle, and by bolts through the vertical angles that are riveted to the sill plate. The wooden concave and convex side panels are sheathed with four sections of cold rolled sheet steel, and at the bottom is a 2 by 3-16-in. steel molding beveled on its top edge. Ash car lines, reinforced with steel, support the Brill plain arch roof.

The window system is the semi-convertible type, in which the sashes disappear in roof pockets. The absence of a rear platform greatly increases the seating capacity over the usual type of car, there being seats for 54 passengers, of whom 5 occupy a circular seat at the rear, the transverse seats, 32, the longitudinal seats at the left, 7, and those on the right side, 10. A greater width of both aisle and seat is obtained in the use of stationary-back transverse seats, having pressed steel pedestals with extensions to support the backs. From the forward bolster to the front platform the car floor slopes downwardly 1½ inches, thereby reducing the step elevation. The interior woodwork is of cherry, all fittings of solid bronze, and the headlining of composition board. Stationary hand straps and signal push buttons are provided. The car is mounted on standard Brill No. 39-E single-motor trucks.

As in other "Nearside" cars that have been built, both the conductor and motorman occupy the front platform. The responsibility is definitely divided between the motorman and conductor. Opening and closing of doors and stopping and starting are entirely in charge of the former, while fare collection, issuing of transfers and announcing of streets are practically the sole duties of the latter, increasing crew efficiency and safe and prompt operation.

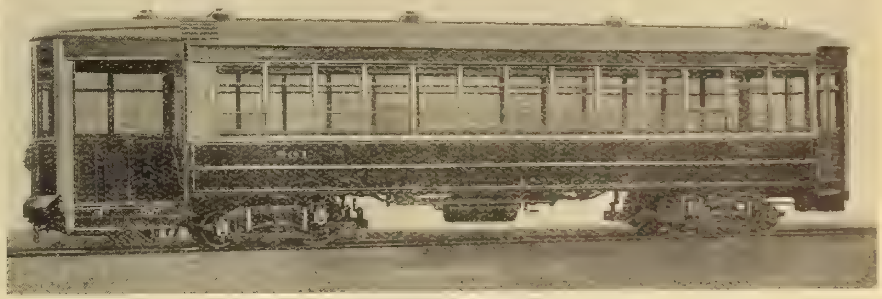


Fig. 2—"Nearside" Car for Vancouver

The principal dimensions of the "Nearside" car follow:

Length over corner posts	34 ft. 1⅜ in.
Length over platforms	45 ft. 1 in.
Length of platform	7 ft. 6 in.

Centers of side posts	2 ft. 6 in.
Width over posts	8 ft. 5 in.
Extreme width	8 ft. 6 in.
From track to side sills	2 ft. 6¾ in.
From side sills over trolley boards	9 ft. 0½ in.
From floor to center of head-lining	7 ft. 11 1/16 in.
From track to step	13 15/16 in.
Step to platform	13 in.
Platform to floor	10½ in.
Seating capacity	54

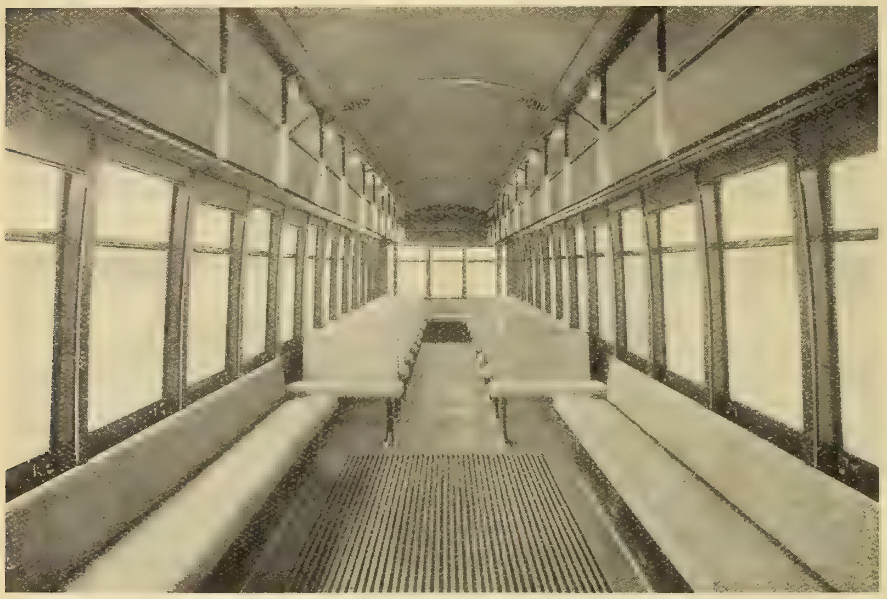


Fig. 3—Interior "Nearside" Car, Vancouver

Type of trucks	Brill No. 39-E
Wheel base	4 ft. 10 in.
Diameter of wheels	33 in. and 22 in.
Weight of carbody less electrical equipment	18,180 lb.
Weight of trucks	10,040 lb.
Total weight less electrical equipment	28,220 lb.

The "Stepless" Car

The "Stepless" car is all-steel, with the exception of a few minor parts, not subject to strain, and some of the interior fittings. The steel bottom frame is built of two 3 by 3 by 5-16-inch angles which are depressed for the low-level floor between the trucks and converge slightly just ahead of each driver axle, where they are spliced to continuous angles of the same size, which are bent around the ends to form the bumpers and anti-climber supports. Directly under each door-opening, and extending slightly beyond, on both sides, an angle is set into the side sill, for reinforcement at that point, actually forming a built-up channel. There are nine crossings in the low level of the bottom frame, each consisting of 3-inch channels, of 4 lbs. section, placed back to back. The body bolsters are attached at the points where the side sills reach the high level over the trucks, and are built-up of 3½x6x3½x⅜-in. Z-bars, depressed between the wheels in order to preserve the low floor and retain the seat-cushions at about the same height throughout the car body proper. The stringers consist of 3 by 2 by ¼-inch angles, riveted to the crossings in sections. The outermost crossing on each end is connected to the body bolsters by two horizontal 4 by ¾-inch flat bars. Two 3-inch Z-bars are riveted to the depression in the body bolster and, diverging slightly, run through to the bumper. These Z-bars are bent upwardly at about 45 degrees near the driver axle, and then continue in the same plane as the side sills, forming the floor framing of the motorman's cab.

The side and roof construction is rather novel, in the use of No. 18 steel box posts, with brass corrugations for sash and curtain fixtures, and pressed-steel door frames, each consisting of two pressed steel sections, set against each other to form a continuous box around the top and sides of the openings.

The side posts and door frames are set in the side sills and riveted to them through angle reinforcement. Continuous pressed-steel top rails run from each side of the door frame to the corner posts and are riveted to the outer sides and tops of these and the side posts, as well as to foot flanges of the steel carlines. The carlines are cut from steel plates and are reinforced at the top and bottom with angles. Large holes, which in no way affect the strength, are cut into the plates, to accommodate the long pipes which are used for air storage purposes instead of the customary drum. Narrow poplar boards drawn over with cotton duck form the roof covering. Pressed steel belt rails, of box section, extend from the door frames to the corner posts and the upper framing along the sides and around the ends is covered with steel sheathing, making the superstructure an extremely stiff girder, in which the pressed-steel door frames, by virtue of their own form, and their connection to the longitudinal members, distribute the load between the car-ends and neutralize the breaking strains in the components of the structure.

Seats 51 Passengers

The interior finish is entirely of metal except the floor, which is laid with the usual yellow pine boards and maple mat strips, the headlining, which is composition board, and the double window sashes, which are wood, lined with brass stiles. The upper sashes remain stationary and the lower are made to raise. The seating plan provides for 51 passengers. In each half of the car are six reversible cross-seats, and two cross-seats with stationary-backs and a circular seat for nine persons between the stationary-back seats and the bulkhead. There is an additional folding seat for one passenger extending the width of one-half the entrance on the side that is not in use, the other half being occupied by the conductor's seat and change desk, from which all his duties may be performed. In lieu of hand straps, white enameled pipe stanchions supplement the grab handles on

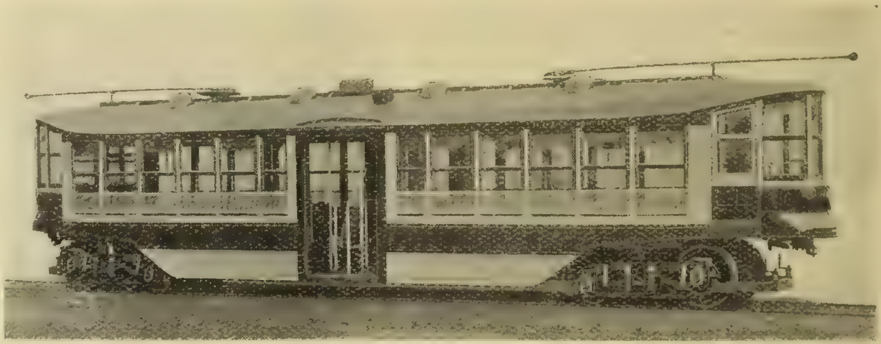


Fig. 4—"Stepless" Car, Vancouver

the seat backs, and push buttons are provided to signal the motorman. The bulkheads, in which there are three double drop sashes are the vertical extensions of plate girders that act as crossings in the bottom framing. The motorman's cabs contain the air compressor as well as the usual electrical equipment. In addition to a sliding door on the right side, with stationary sashes, there are four double-sash windows, the lower arranged to raise. In this type of car the motorman's seat is considerably higher than in usual cars and gives him the advantage of a good view ahead and to each side. The car is mounted on specially designed Brill No. 62-E single-motor trucks, in which the bolster is carried sufficiently low to accommodate the low floor over the trucks.

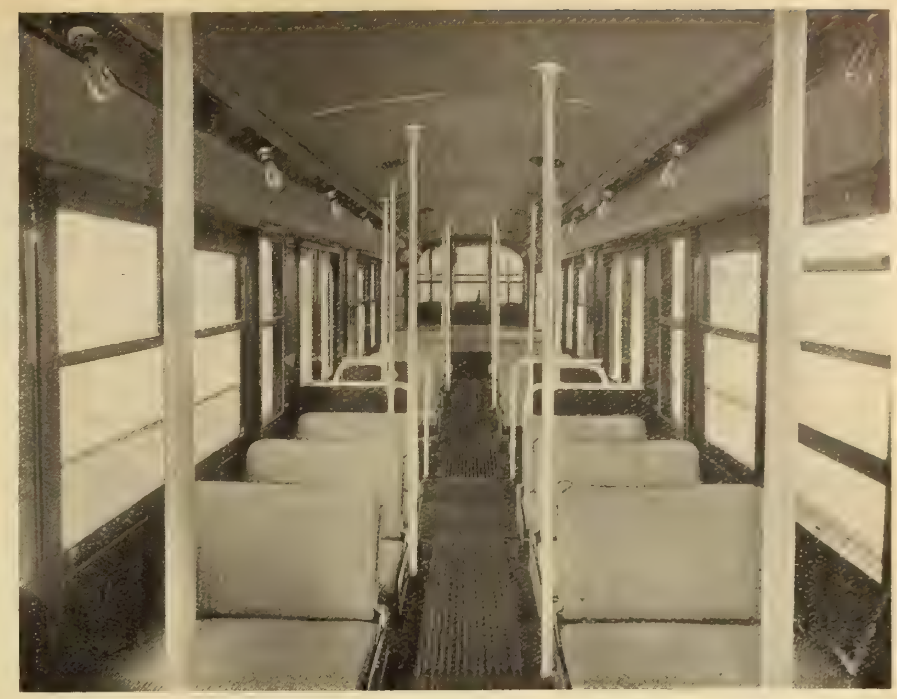
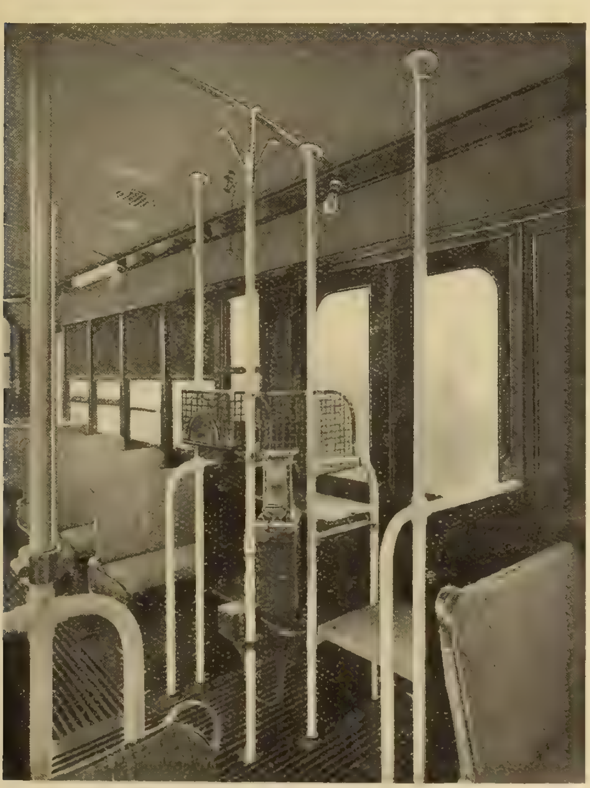


Fig. 5—Interior "Stepless" Car, Vancouver

In the accompanying sketches Fig. 2 represents the exterior appearance of the nearside car, folding doors and steps at platform are operated by the motorman; an emergency exit at the rear is operated by the conductor; trucks are Brill No. 39-E single motor. Fig. 3 shows an interior view of the same car; seating capacity 54; circular seat in rear 5; transverse seats 32; longitudinal seat at left 10, at right 7. Fig. 4 shows the double sliding doors of the stepless car; these are pneumatically controlled by the conductor and act as a line switch and break circuit when open; special Brill trucks. Fig. 5 shows the interior of the stepless; cross seats accommodate 32; 2 circular seats at the ends 18; folding seat at door 1; total 51; white enamel pipe stanchions supplement grab handles on seat backs; lower sash of windows raise full height; upper sash stationary. Fig. 6 shows the movable conductor's desk with fare box and register and folding seat for one passenger opposite entrance-exit; doors are controlled by foot-actuated air mechanism on stanchion holding fare box; the conductor's seat is high to afford view over passengers' heads.



Fig, 6—Showing Conductor's position

The principal dimensions of the "Stepless" car follow:

Length over all	44 ft. 0 in.
Length over vestibules	43 ft. 0 in.
Length of front platform	4 ft. 4 in.
Length of rear platform	4 ft. 4 in.
Centers of side posts	2 ft. 5⅛ in.
Width over sills	8 ft. 1½ in
Width over posts	8 ft. 1⅝ in.
Extreme width	8 ft. 3 in.
From track to side sills	9½ in.
From side sills over trolley boards	9 ft. 0⅛ in.
From floor to center of head-lining	8 ft. 0 in.
Track of floor	11½ in.
Seating capacity	51
Type of trucks	Brill Special No. 62-E
Wheel base	5 ft. 0 in
Diameter of wheels	33 in. and 21 in.
Size of journal	3¾ x 7 in.
Type of motors	GE57—2-50 h.p.
Weight of carbody less electric equipment	17,500 lb.
Weight of electrical equipment	1,000 lb.
Weight of air-brake equipment	1,400 lb.
Weight of trucks	9,640 lb.
Weight of motors	5,944 lb.

Both these experimental cars were purchased from the J. G. Brill Company, of Philadelphia.

The Morrisburg and Ottawa Electric Railway

Tenders have been called for ties, poles and steel rails; also for telephone equipment including the installation of the same. Prospects are reported very bright for the construction of this road at a early date, and it is the present intention to begin active work during the month of April.

Will Electrify Main Lines

The Grand Falls Power Company of Montana, has been given power to transmit under government regulations, sufficient power for the electrification of 450 miles of tracks of main line of the Chicago Milwaukee and Puget Sound railroad.

Illumination

The Cooper Hewitt Quartz Lamp

The Quartz lamp represents an additional commercial development of the principles involved in the vapor lamp invented by Dr. Peter Cooper Hewitt. In principle, the difference between the standard Cooper Hewitt lamp and the Quartz lamp is only the greatly increased pressure of the luminous vapor in the latter. The standard Cooper Hewitt lamp is not ordinarily run at a higher density than a pressure equal to about ⅛-inch mercury column, while the pressure in an operating quartz lamp may be that of the atmosphere or higher with the result that the temperature in the luminous vapor is extremely high. With the high vapor pressure potential fall per inch of the luminous column is very great, thus necessitating the use of a correspondingly short tube.

The ordinary Cooper Hewitt lamp and the Quartz Cooper Hewitt lamp in spite of having been built upon the same physical foundations, represent from the practical point of view, two contrasting types; the one possessing great area of luminous surfaces with a consequent small intrinsic brilliancy and a low temperature; the other with a small radiant surface giving a very concentrated and intense light and working at very high internal temperatures. Besides the discontinuous spectrum characteristic of mercury the Quartz lamp, owing to the high temperature, omits, like other incandescent bodies, a luminous spectrum, and it is due to this circumstance that the light of the Quartz lamp contains, besides the predominant yellow, green, blue and violet lines of the mercury spectrum, red and orange rays, there being more of the latter the higher the vapor temperature.

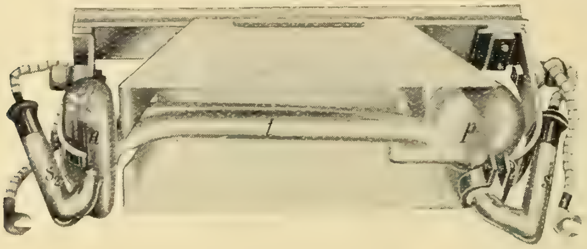


Fig. 1

A vacuum container for the direct current Cooper Hewitt Quartz lamp is shown in Fig. 1. Its main part is the tube "t" carrying the luminous vapor terminating on one (the positive) end of an enlargement "p" and on the other (negative) end in the lateral tube "n." Mercury in each enlargement forms the two electrodes, which receive the electric current by small upright U tubes "s_1," "s_2." Rods of slightly conical shape, of a special alloy, are ground into the wall of these upright tubes and the joints are covered with mercury which again is closed in by a layer of a suitable compound to prevent access of air and prevent the mercury from being spilled or vaporized.

The essential parts of a commercial Quartz lamp outfit are the following:—A series resistance for regulating the burner voltage and making the lamp adaptable to a wider range of supply voltage; a series induction for steadying the arc; a glass globe to prevent too rapid a dissipation of heat from the burner, and to absorb the ultraviolet rays; and, if the lamp is to be automatic, a starting device.

When a cold Quartz lamp is started it requires, owing to the small drop of potential at the low pressure, a rather high current and the whole cross-section of the luminous tube of the burner is filled with a pale bluish-green light. But presently, as the lamp warms up, the appearance changes; the light recedes from the walls, and, with increasing vapor pressure, becomes concentrated in the center of the tube in a thin dazzling path. The current, at first steadily dropping, becomes stationary, and the appearance of the light assumes a whiter color with a visible gain of red and orange rays as the lamp attains its temperature of operation. The change of the lamp current, and the voltage of a 220 volt—3.5 amp. Cooper Hewitt Quartz burner with reference to the time after starting is shown in Fig. 2.

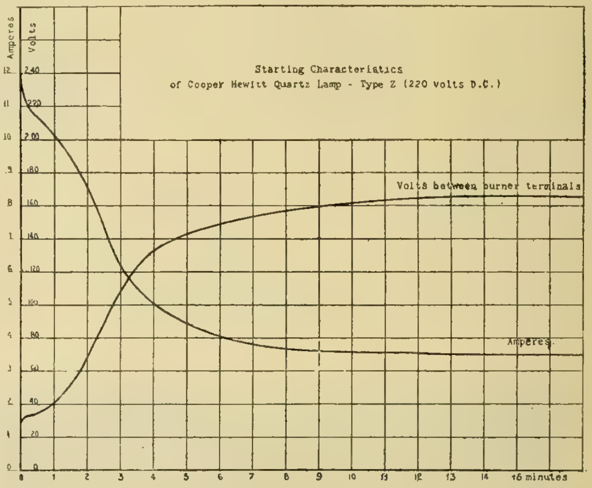


Fig. 2

The ultraviolet rays in which the mercury is especially rich, and which are readily transmitted by quartz, may be considered injurious to the eyes for a short distance. The most actinic of these rays, that is, those with the shortest wave length, are absorbed by passage through a few inches of air; further, all are completely absorbed by common glass, so that a surrounding globe of clear glass affords absolute protection from these rays. The bacterial and physiological effects of the ultraviolet rays are too well known to be dwelt upon here but they have no effect when the light has passed through a glass globe. When a Quartz lamp is used for the purpose of the generation and utilization of ultraviolet rays, no glass should be inserted in the path and the lamp should be placed as close as possible to the exposed object.

Two types of Cooper Hewitt Quartz lamps are here described. These are for multiple connection on d.c. lines, one for 110 and the other for 220 volts. From a.c. supply circuits they may be operated through the medium of the Cooper Hewitt rectifier.

The 110 volt-4 amp. Quartz lamp is shown in design, in Fig. 3. This figure shows a burner, b, similar to that in Fig. 1. The burner is securely held in an aluminium support, s, to which a white enameled reflector, r, is fastened. The holder with its T-shaped backbone is pivoted in a support, c, and by means of the tilting lever, l, is linked to the movable armature of an electro-magnet, m. In order to avoid sudden shocks to the movable parts, a dash pot, d, is connected to the armature. A small movable permanent magnet, p, is suspended above the armature; it locks automatically the tilting device when the polarity at the lamp terminals is reversed and so protects the burner against being destroyed by a reversal of polarity. Two small resistance coils, r_1, r_2, one equipped with a fuse wire, f, and a sliding contact for regulation, complete the auxiliary apparatus. The ventilated canopy, the insulated hanger and the ring holding the glass globe are very similar to those used with arc lamps.

Burner, magnet and resistance are all connected in series and the burner in its position of rest is inclined, so that the two mercury electrodes are in contact. When the line switch is turned on the short circuit current magnetizes the solenoid m, the movable armature, and with it the burners are turned on their pivots until the contact between the two mercury electrodes breaks and the arc starts. As long as the lamp is under current the burner is held in its running position by the magnet. The fuse wire, f, will withstand the heavy current during the starting period of the lamp, but will, within one minute, be fused by the additional heat generated in the resistance spool, r_1, if for any reason the mechanism should stick and the short circuited burner continue to receive current.

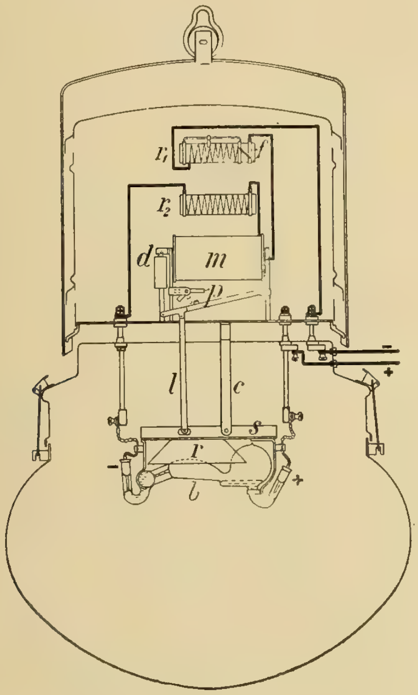


Fig. 3

The 220 volt-3.5 amp. Quartz lamp shown in diagram in Fig. 4, has a burner and a general appearance very similar to the above described, but its mechanism is different. The running position of the Quartz burner, is identical with its position of rest. For starting, the two electrodes are brought in contact by the movable armature of a shunt magnet, M_s, At the moment of the short circuit between the electrodes the series induction coil m, operating an automatic cut-out, l, is energized and interrupts the circuit of the shunt magnet, so that the burner drops back to its original position and the arc is lighted. This auxiliary is also provided with an automatic locking device for protection against reverse of polarity. Four series resistance coils r_1, r_2, r_3, r_4, the first two of which are equipped with the sliding contact, complete the mechanism.

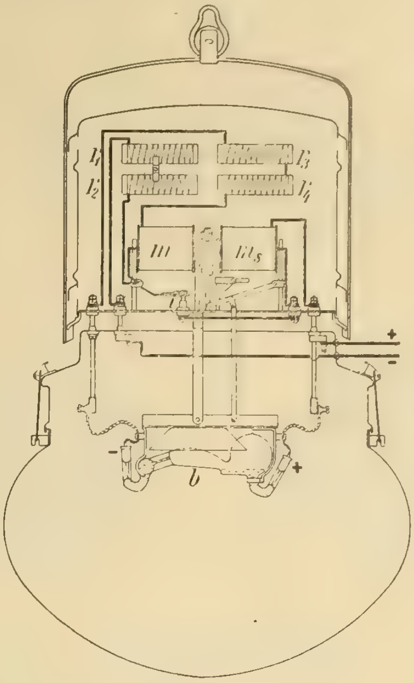


Fig. 4

New Things in Holophane

For large interior lighting, such as the lighting of churches, public halls, stores and rooms of unusual dimensions, the larger sizes of the tungsten filament lamps are found to best meet the requirements of the high standard of illumination now demanded. They at least have the preference over other high intensity lighting units at the present time. The extreme brilliancy of these units, particularly in sizes ranging from 150 to 500 watts, has in many cases occasioned less thought and study as to results in illumination than was formerly given to the same wattage divided into smaller units. Globes and reflectors are often used that

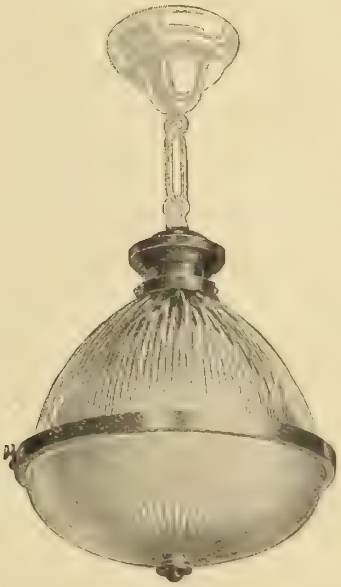


Fig. 1

have too much absorption or, by lack of proper calculation, do not influence the light, so that results on the plane to be illuminated fall far below the maximum that could be obtained. A great glare of light often misleads the layman into thinking he has an ideal lighting scheme, when with the proper treatment of the unit he could obtain double the value, or the same illuminating value much more economically.

To meet the demand for obtaining maximum results in the use of these lamps the Holophane Company, Limited, Toronto, have recently brought out several new units that are remarkable in affording illumination results as well as opportunities for ornate fixture treatment.

The Realite, it is claimed, is unequalled for results in illumination by any total enclosing unit. It consists of a most powerful concentrating reflector, Fig. 1, used in conjunction with a shallow satin finished diffusing bowl the two joined by a metal band. The results are wonderful and the fixtures can be made plain or may be elaborated upon to suit the users' fancy.

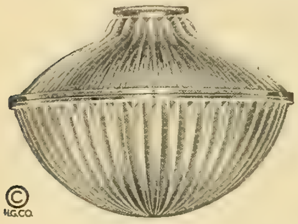


Fig. 2

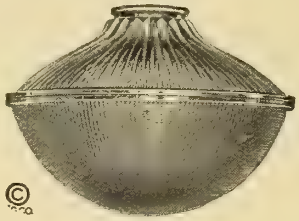


Fig. 3

The new two piece Reflector Bowl units, Figs. 2 and 3, are similar to the Realite but utilize different bowls and afford some extremely pleasing effects. These also give the fixture dealer much latitude in working out rich effects and, like the Realite, come in sizes for the 150-250-400 and 500 watt tungsten lamps. There is an immense field for these units and dealers and central stations who are building up their own interests by promoting greater satisfaction among their customers, will find these will greatly supplement their efforts in this direction.

Canada's Northern Water Powers

Very little is yet known of the value of the natural resources of Canada's far northwest, though explorers have, from time to time, described, in general terms, the great rivers, such as the Mackenzie, the Athabaska, the Slave and the Peace. During the past two summers, the Commission of Conservation has had a hydro-electric engineer at work gauging streams and examining possible water-power sites in this region. Two of the rapids examined were the Fort Smith rapids and the Peace River canyon.

The Cassette, Mountain, Pelican and Drowned rapids, collectively known as the Fort Smith rapids, are situated on the Slave river and extend from Smith Landing to Fort Smith, a distance of some 16 miles. The various rapids, whose descents, taken separately, vary from 10 feet to 38 feet, may be considered as a continuous rapid from head to foot, broken by short intervals of swift water, giving a total descent, in the 16 miles, of some 135 feet. It would probably be difficult to group all these rapids into one development, although it would be very desirable to do so from the standpoint of conservation, but numerous islands and projecting points from the mainland afford natural conditions for easy development. The volume of water in these rapids is enormous, being the combined flow of the Peace and Athabaska, and their tributaries, with one of the great northern lakes, Lake Athabaska, acting as a reservoir to regulate the flow. The total power available during the season of navigation (May to November), by utilizing the total head of 135 feet, is estimated at 1,000,000 h.p., and is divided among the different rapids in proportion to the head in each. Raw material for pulp and lumber industries is found all along the river and at the rapids.

The Peace River canyon has long been renowned for the wild character of its waters, and no white man or Indian ever attempts to run its rapids. The descent from head to foot is some 225 feet in a distance of less than 18 miles, which suggests its possibilities as a water-power. The total minimum power available during the open-water season (May to November) is estimated at 400,000 h.p. This is based on the assumption that the total head of 225 feet can be utilized. Its development for water-power purposes will involve rather intricate problems, but to compensate for this, one must consider its situation near the raw material for pulp and lumber industries. It is also at the head of navigation of the Peace river and lying adjacent to it are immense coal fields, a large portion of which have already been staked out.

Personal

Mr. G. W. Jones, Port Hope, is president of the Canadian Independent Telephone Association.

Mr. Thos. Coleman, until recently with Chapman & Walker, Toronto, has been appointed superintendent of the Charlottetown, P.E.I., Light & Power Company.

Mr. E. A. Graham, formerly assistant to Mr. C. R. Ross, resigned, has been appointed to the position of Electrical Engineer for the Winnipeg Electric Railway Company.

Mr. F. Jno. Bell, general manager Canada Wire & Cable Company, left Toronto a few days ago for a trip to Vancouver and other western cities.

Mr. R. H. Long, formerly assistant superintendent of the Winnipeg Electric Railway Company's hydro-electric plant at Lac du Bonnet, has been appointed to the position of electrical superintendent of the company.

Mr. C. R. Ross has resigned his position as Electrical Superintendent and Engineer for the Winnipeg Electric Railway Company. Mr. Ross has been with the company in this capacity for the past six years, and now leaves to engage in private business.

Mr. C. H. Cahan, K.C., president of the Western Canada Power Company, is now in England, with reference to the proposed contract to sell power to the British Columbia Electric Railway Company. Both companies have made proposals, neither of which apparently have been acceptable to both.

Mr. C. M. Tait has been appointed to succeed Mr. James Bennett as chief electrical inspector of the Canadian Fire Underwriters' Association, Montreal. He has been for two years chief assistant to Mr. Bennett, who retires at the end of March. Mr. Tait has had a long experience in electrical work, having been connected with the Westinghouse and General Electric companies and the Block Signalling department of the C. P. R. Prior to joining the Fire Underwriters' staff, he did a large amount of inspection work under the late Mr. F. H. Badger and Mr. W. J. Plews, during the period when inspection was not on such a well organized basis as it now is.

Mather, Yuill & Company have just completed their contract for the installation of 66 ornamental cluster lighting standards on Robson street, between Granville and Jervis streets, Vancouver. These standards are of similar design to those already installed in the principal streets of the city.

The Dealer and Contractor

Electric Vehicles

The subject of the influence of electric vehicles on central stations, and on the other hand of central stations on electric vehicles, has been discussed more or less widely. From the central station point of view the electric vehicle seems to present tremendous possibilities in the way of increasing its load factor in that current required for charging the batteries is used or can be used in ninety-nine cases out of one hundred at hours when the energy is not being used for other purposes. It follows that in hydro-electric plants at least, this is clear gain to the central station and is almost so in any case where the machinery has to be kept running.

The other point of view—the influence of the central station on the electric vehicle—has not received the same attention, but was recently given prominent notice in a paper read by Mr. Stephen G. Thompson at a recent meeting of the Electric Vehicle Association of America. Mr. Thompson's paper and two charts, showing the influence of an organized attempt by his company to work up the electric vehicle business, are given herewith.

Probably no better example of the influence of the central station on the electric vehicle industry exists than in those sections of New Jersey served by the Public Service lines. Two years ago this territory presented a virgin field for electric vehicle exploitation. The manufacturers themselves were but casually attempting to market their product, and the public at large was not sufficiently informed of the merits of electric vehicle operation to take kindly to its adoption. Aside from a few commercial vehicles operated by manufacturing plants and by New York business houses, but few of these machines were in use, and, with the exception of those power wagons owned by the Edison Storage Battery Company and allied interests, there were no large installations in the state. Pleasure vehicles had met with little favor, there being a total of but 80 machines —many of an ancient type and nearly all but infrequently used.

An investigation of the electric vehicle conditions in those cities which were leaders in the use of these machines influenced the Public Service Electric Company to attempt their introduction in its territory, and for that purpose an Automobile Department was established, whose accomplishment in the introduction of vehicles is graphically represented by Chart No. 2, which shows the increase in the number of vehicles since the inception of this department.

Curve "D" represents the number of vehicles within the territory.

Curve "E" shows the total number consuming current from the Public Service lines.

Curve "F" shows the number of pleasure vehicles in use.

Curve "G" shows the number of vehicles of the commercial type.

It will be observed that the increase in the number of pleasure vehicles is practically a straight line rise. This is accounted for by the fact that the attitude of the Public Service Company immediately influenced the manufacturers of these machines to engage actively in marketing their product in this territory. The variations from the straight line curve are attributable to the influence of the seasons.

The commercial vehicle increase is shown to be of a slower growth during the early period of activity, while the rise in the last few months is quite marked. This is a natural condition, as the development of power wagon use necessarily requires a longer introductory period of education than that of the pleasure machines.

An analysis of the power wagon conditions in this territory to-day discloses some rather astonishing facts regarding the status of the electric commercial vehicle, and if these conditions may be accepted as an indication of the general

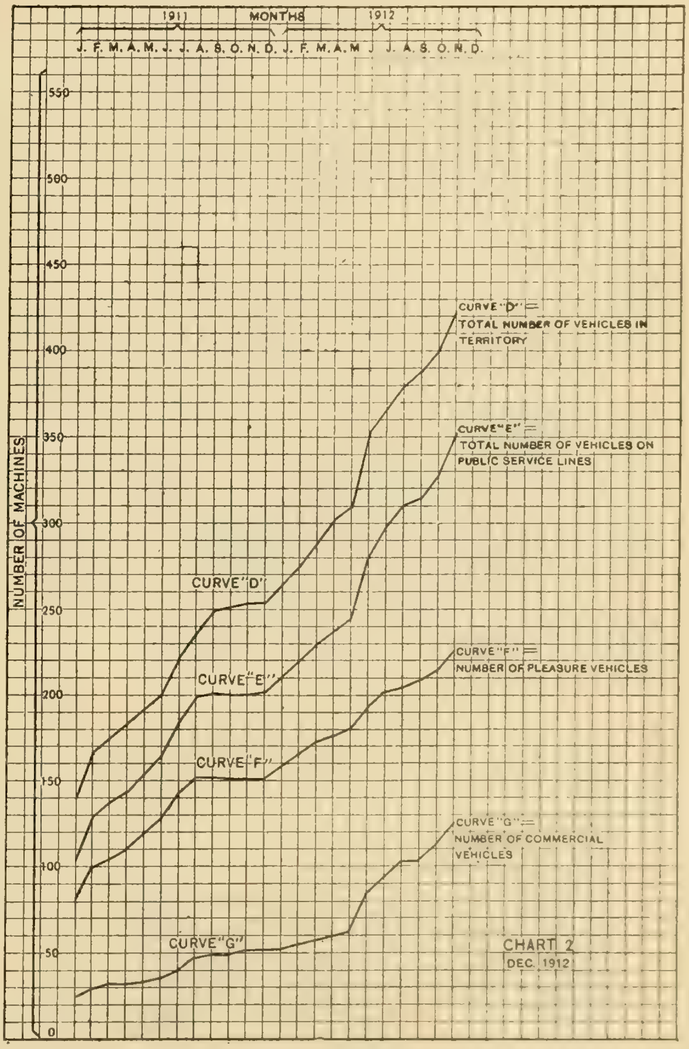


Fig. 1—Chart No. 2

trend throughout the country, we need have no fear for the future of the electric commercial power wagon industry.

At the present time we find a total of 731 commercial vehicles of all types employed within this territory. From the curve it will be observed that 191, or 26 per cent. of these are electrics. The balance are gasoline machines. As this 26 per cent. in electric machines represents the product of but nine vehicle manufacturers, while the 74 per cent. of gasoline machines were marketed by 158 makers, it would appear that the electric vehicle manufacturers are certainly obtaining their full share of the total power wagon business.

If we go further into the analysis of these figures, we discover that of the 540 gasoline machines in operation, 355 are low-grade cars whose selling price is in the neighborhood of $1,000. In this class are represented 60 vehicle makers, while the balance of 185 gasoline cars are the product of 98 different companies. In other words, over fifty per cent. of the total number of high-grade power wagons employed are of the electric type. Let me impress this statement upon you more strongly. Nine electric vehicle manufacturers, in competition with 98 gasoline makers, have marketed fifty per cent. of the total number of machines of similar quality employed within the territory under discussion. Under the circumstances it would appear that the acceptance of the gasoline power wagon is the influence of numbers rather than of quality or of possible application.

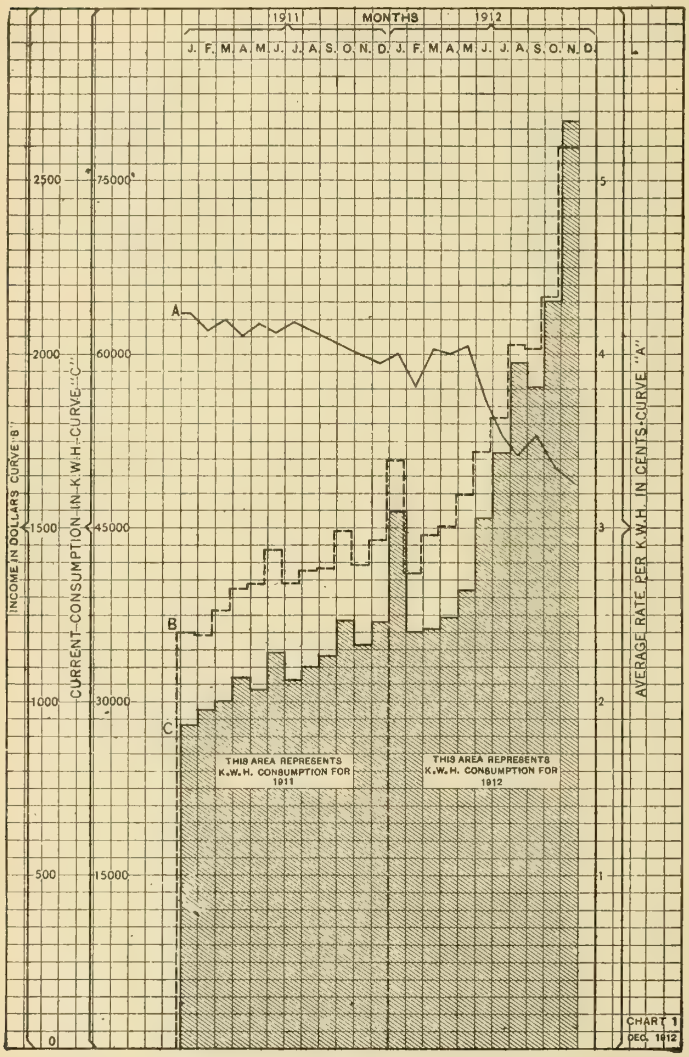


Fig. 2—Chart No. 1

Chart No. 1, showing the increase in kw. consumption and income, will appeal strongly to the central station manager, as the data therein contained indicates just what the use of power wagons means to his department.

Curve "A" represents the average income rate per kw.h.

Curve "B" represents the income in dollars.

Curve "C" represents the kw.h. consumption.

If this plotting is compared with Chart 2 it will be observed that the rapid increase in power consumption follows a marked increase in the use of commercial vehicles, and points to the fact that the introduction of these machines is of far greater importance to the central station than is that of the pleasure vehicle.

The decrease in the average kw.h. rate as shown on Curve "A" is attributable to the fact that a majority of these commercial power wagons are in the larger installations, and public garages, paying for their service at the wholesale power rate.

While these curves are plotted to the first of December, it is interesting that the indications point to a continued rise throughout December because of the vehicles which have been sold, but are not yet delivered, and assurances of additional business from cars not now charged from the Public Service lines, which are at present included in Curve "D," Chart No. 2. Of these are some 40 machines of the commercial type.

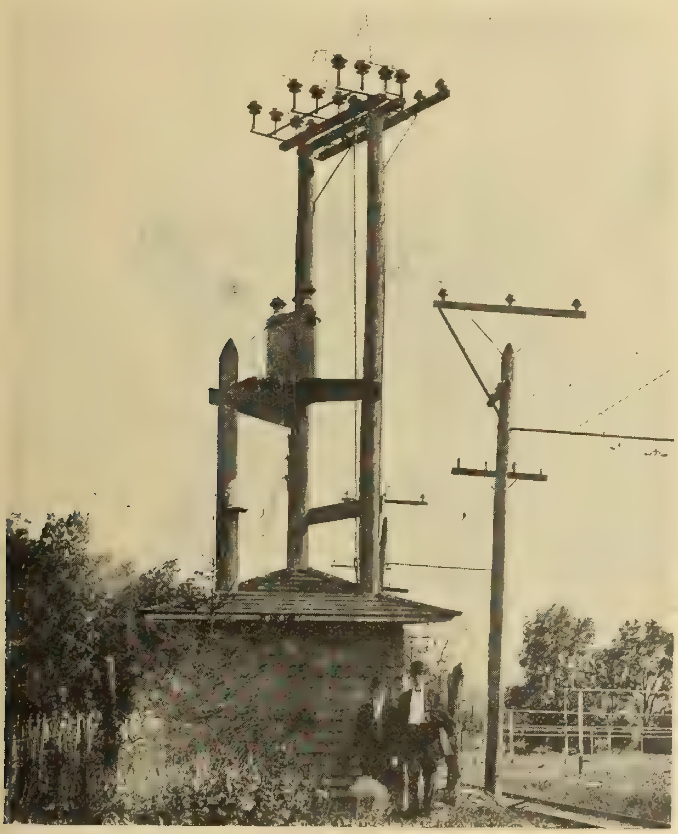
It is evident from the foregoing that the influence of the central station on the electric vehicle industry is far-reaching in its results, and from reports of the vehicle manufacturers themselves, I have every reason to believe that educational campaigns in other sections have produced a marked increase in the number of electric commercial vehicles employed. I am strongly of the opinion that if central station managers would make a market investigation of the local conditions, with a view to promoting the use of electric power wagons, they would find the field to be much larger than is generally believed; and, further, that the business can be secured with a very reasonable expenditure of money. This is borne out by the fact that in the operation of our Automobile Department our income has always exceeded the amount expended in promoting the use of electric machines, and we shall finish the year 1912 with a good profit. From our experience and our faith in the future of the electric vehicle, we feel that the ultimate wholesale introduction of power wagons can best be attained by continued effort along the lines which we have pursued during the past two years, rather than through extensive expenditure of a more or less speculative nature. Possibly we are wrong in our premises, but at any rate it is good business procedure.

An Ideal Electric Plant on the Farm

One of the most important developments of the next few years in many parts of Canada will be the extension of electric power and light lines for the use of the more progressive farms. There is no doubt about the adaptibility of electrical equipment for this work and the main factors standing in the way of its more general adoption in the past have been (1) the absence of power lines in farming districts; (2) the cost of the equipment; (3) the ignorance of this class of consumer of the possibilities of electric power. The first difficutly has now been removed in a large number of communities not only in Ontario but in various sections at different places in Canada. The cost of apparatus suitable for this class of work is also being slowly reduced without any loss in its efficiency or dependability. Much has also been done to educate the farmer and he is showing himself an apt pupil in grasping the ideas contained in the demonstrations of the last year or two.

A brief description of an actual installation which has been found to work with remarkable success will therefore be of interest to all and of value to many. Such a description follows of electric equipment installed on a very valuable 60 acre farm owned by Mr. W. W. Mills of Marietta, Ohio. The farm is situated about 2 miles outside the town. The transmission line carrying 22,000 volts runs past the farm. Mr. Mills has installed a transformer to step this voltage down to ordinary working pressures, that is, either 220 or 110, and has equipped his farm with all the useful apparatus available, thereby reducing labor costs, and increasing the efficiency of the laborer.

The accompanying illustration indicates the simplicity of such an installation. It consists of a 3-phase, 60 cycle, 15 kv.a. standard outdoor type transformer giving either 110 or 220 volts. The small building shown contains a switchboard, a watt-hour meter for measuring the energy used, and an auto-starter for a 10 h.p. motor located about 1,200 feet away on a river bank and which is used for pumping water into a tank located just behind Mr. Mill's house. On occasion this water system is also used for irrigating the farm, an operation controlled by means of several valves which can be opened or closed, and the water allowed to flow by gravity through piping. This pipe is perforated at intervals thus spraying the water over the land.



Electricity on the Farm

Appreciating the many advantages of electrical devices in the home, further advantage has been taken of this electrical installation to light the residence and farm buildings and equip them with the many modern electric devices that do so much to make home-life comfortable. Accordingly there have been installed in the residence, an electric toaster, stoves, irons, vacuum cleaner, a motor-operated sewing machine, etc.; also the washing is done by an electric washing machine. The out-buildings are equally well equipped to enable the farm hands to carry on with efficiency and despatch the drudging work that under present conditions every farmer has learned, more or less, to dread.

This installation has proven conclusively to the company owning the power line that it is entirely feasible to use for power and light purposes a 22,000 volt transmission line which had hitherto been used only for supplying energy to an electric interurban railway. It is now the intention to supply a number of villages and farms along the line in this way and thus derive a considerable revenue at a comparatively small outlay of money. It is calculated by this company that if they are able to make from ten to fifteen taps ranging from 15 to 100 kv.a. capacity on a transmission line of from fifteen to twenty miles in length, they would derive sufficient revenue to pay entire maintenance charges of the line.

This view of the situation is becoming more thoroughly appreciated by central station managers throughout Canada and the prospects are that the year 1913 will see a very considerable amount of business secured from farmers along interurban lines. Around Toronto four companies are already making a revenue from this source, or are prepared to do so. The Hydro-electric Power Commission of Ontario are supplying a limited number of farmers. The Electric Power Company operating in the Trent Valley are also following this course, the intention being to develop that kind of business. The same can be said of the Toronto and York Radial Railway Company, Toronto Electric Light Company and allied interests.

The installation of the electrical equipment in this case was made by the Westinghouse Electric and Manufacturing Company. The fact that out-door switching and transformer equipment can now be obtained standard, obviates the necessity for a large enclosing station, and so reduces the cost materially.

Pole Top Disconnecting Switches

The pole top switches are an essential feature of every well designed transmission system and are coming into more general use as the sole switching equipment of the high voltage side of outdoor sub-stations. Such switches should be made so as to open all poles at once from the ground, in order to ensure the safety of the operator. They can be obtained in single, double, triple or four pole types of either the single or double break feature per pole, as well as in a combination of these features for use in connection with fuses.

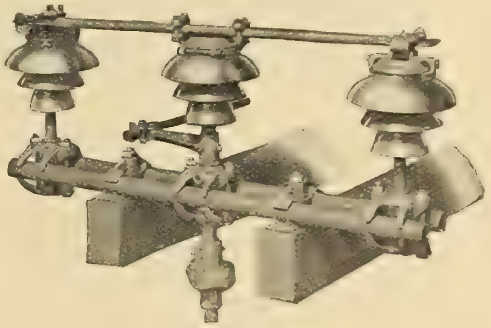


Fig. 1

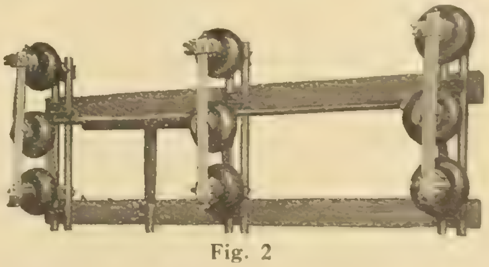


Fig. 2

A single pole of a 30,000 volt, 150 amp., pole top switch of the double break type is shown in Fig. 1. The contacts are of the flexible, self-aligning type. The switch is furnished so that it can be locked in either the open or closed position as desired. This style of switch when equipped with discharging horns has been found capable of breaking considerable loads.

A triple pole 22,000 volt, 100 ampere pole top switch of the single break type is shown in Fig. 2. This style of switch can readily be mounted either vertically or horizontally, the control handle adapting itself to either mounting, as well as at either the center or the end of the switch as desired. The switch as illustrated in Fig. 2 is not equipped with fuse tubes or fittings, but can be so furnished if required.

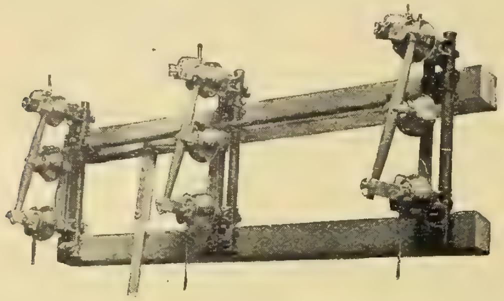


Fig. 3

In Fig. 3 is shown a triple pole 15,000 volt, 100 ampere combined switch and fuse, the usual switch blade in this type being supplemented by a hickory tube boiled in linseed oil, dried and then varnished. The hickory tube contains the fuse, which is readily renewable. The switch and control handle can be mounted in a similar manner to that described above.

All three types of pole top switches have been so designed that the work required for installing them is of the simplest and most elementary nature, consisting of bolting the switch units, which are shipped completely assembled, to the arms and attaching the control. The switches are built with clamped pipe arms, and are capable of adjustment in every way, thus affording a rigid construction readily adaptable to standard pole line framing. It is only necessary for the user to furnish the required pole and cross-arm work. Of the many uses to which switches of the type described above have been put, the most usual are:—Opening branch lines, disconnecting transformer banks, diverting energy past sub-stations when installed upon the roof, disconnecting portable sub-stations from high-tension lines of electric railways, and as line sectionalizing switches. The switches illustrated above are manufactured by the Electrical Engineers Equipment Company, Chicago.

Large Pumps for Ottawa

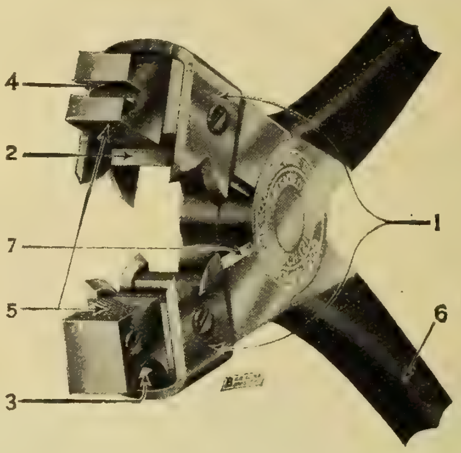
In addition to the two Rees Roturbo centrifugal pumps, electrically driven, for the city of Ottawa waterworks system (mentioned in our January 1 issue), Heap & Partners, Ltd., Montreal, have supplied to the same city three sets of similar pumps, of a capacity of 15 million gallons each. The motors are by the Canadian General Electric Company, and are 50 h.p. 900 r.p.m. 3 phase 60 cycle 550 v. squirrel cage type. These pumps were delivered at Ottawa in five weeks after the receipt of the order. Heap & Partners have delivered two Rees Roturbo pumps for the Brampton, Ont., waterworks, the motors being by the Lancashire Dynamo and Motor Company of Canada, Limited. The pumps are arranged so that they can be operated either in series or parallel. Another order for pumps is for the Dunnville, Ont., Waterworks Commissioners, these being also arranged in the same way.

An 'Ideal' Move.

The Ideal Electric and Manufacturing Company of London, Ont., have moved from their old locations on Bathurst street to larger premises on Talbot street, London, where their new factory is fully equipped to take care of their growing trade in iron, toasters, radiators, stoves and other electric heating devices. The "Ideal" line is well known to the trade and is growing in popularity year by year. A change in the personnel of the firm has recently been made through the dropping out of Mr. T. Agar, whose place has been taken by Mr. R. J. Gracey who will carry on the business in partnership with Mr. W. A. Cooper.

New Wire Pliers

The accompanying cut illustrates the Goodridge Wire Skinner, a tool that will go far towards revolutionizing the method of making connections on insulated wire. The peeling of an insulation with a jack-knife is at best slow and tedious, to say nothing of the quality of the work, whereas one clip of the jaws of the Goodridge wire skinning plier accomplishes the same thing quickly and neatly. The above figure indicates the various parts of the tool as follows: 1 represents the knives for cutting the insulation; 2 is the knife for stripping the insulation; 3, a knife for scraping the wire; 4, a slot for bending loops in the end of the wire; 5, jaws for pulling off the insulation; 6, handles; 7, side cutting jaws.



As it is calculated that No. 14 wire is used in much greater quantities than any other size, this tool is only made for that wire number at the present time. This plier is manufactured by Mathias Klein & Sons, Chicago, Ill.

1913 Diary

F. Reddaway & Company, manufacturers of the well-known "Camel" and "Camel Hair" brands of belting and linen fire hose, stitched cotton belting, etc., 595 St. Paul street, Montreal, Que., have sent out to their friends a useful little pocket diary neatly bound in red leather. The diary contains pages for memoranda of various kinds as well as a useful assortment of general information upon subjects which everyone wishes to have at his finger ends. The company advise us that although the supply is limited they will reserve a few copies of this useful little pocket book for readers of the Electrical News who may inquire for it.

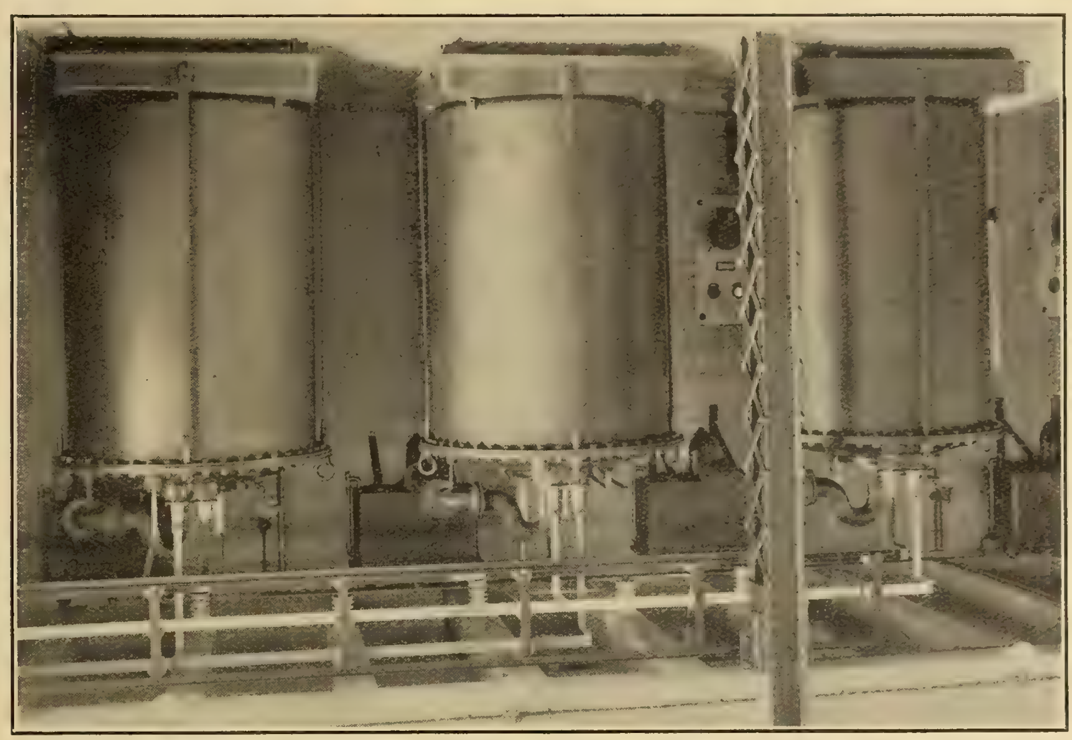
Sterling Telephones

The sole Manitoba agency for the Sterling Telephone and Electric Company of London, Eng., is now held by the Canadian British Engineering Company, Limited, 324 Smith street, Winnipeg. The Jas. Stuart Electric Company were formerly the agents. It is announced that the Canadian British Engineering Company will carry a large stock of apparatus and be able at all times to make prompt delivery.

SIEMENS BROS. DYNAMO WORKS | SIEMENS BROS. & CO.

SIEMENS

SIEMENS - SCHUCKERTWERKE | SIEMENS & HALSKE



3 of 7 Siemens 22,000 volt single phase oil insulated water cooled transformers supplied and installed for the city of Port Arthur

Four of the above were a repeat order after the first bank had been in successful operation for eighteen months.

We also supplied the whole of the switching apparatus, lightning arresters and two 750 h.p. motor generator sets.

Attention is especially drawn to the expansion vessels connected by a pipe to the top of the transformer case. Our transformers are completely filled with oil including this connecting pipe, and part of the expansion vessel, expansion and contraction of the oil taking place in the latter.

By means of the peculiar shape of the connecting pipe the hot oil by the time it rises to the expansion vessel is sufficiently cool so that **no hot oil comes in contact with the air, and no moisture can enter the transformer itself.** This arrangement also keeps the oil in perfect condition and prolongs the life of the transformer.

Siemens Company of Canada, Limited

HEAD OFFICE:
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STANDARD BANK BUILDING
TORONTO

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Independent Electric

The Independent Electric Manufacturing Company announce the completion of their new factory in the city of Milwaukee.

This new and larger building, made necessary by the growing demand for their products, is thoroughly modern in every respect and is equipped with ever facility for an increased production of electrical controlling devices of the highest quality. The new Experimental Department is additional facilities for the development of new devices to supplement their already very complete line.

Thordarson's Improved Sign Lighting Transformer.

Reports of advances made in the commercializing of electricity are always received with great interest, and this is true of the recent announcement of an improved sign-lighting transformer by the Thordarson Electric Manufacturing Company of 503 S. Jefferson street, Chicago. Like all their electrical apparatus, the Thordarson improved sign-lighting transformer was designed and made with a complete and experienced knowledge of exact service conditions and the materials and workmanship are the best obtainable. The radical improvements incorporated in these transformers by the Thordarson experts are said to be strongly endorsed by the National Board of Fire Underwriters. The new model is very compact and neat in appearance and is claimed to be the smallest transformer on the market, also weighing less than any other type. At the same time highest efficiency is attained and it is guaranteed to withstand a breakdown test of 2,500 volts between the primary, secondary and core. Some of the largest sign manufacturers have already given the new transformer an exacting trial and report every claim fully sustained in use. The illustration covers the improved type. Eight stock sizes 100 to 2,000 Watts inclusive.

Bruce Peebles & Company Personals

Mr. Lee Murray has been appointed to the seat on the board of directors recently vacated by Mr. Chas. H. McEuen.

Mr. S. E. Bastow and Mr. J. H. Bunting have been appointed joint managers in the place of Mr. Murray, who has retired from the position of general manager of the company.

The Engineering Equipment & Supply Company, electrical apparatus, 410 St. James street, Montreal, announce that they have opened a branch office in the Stair Building, Toronto (phone A. 3096), in charge of Mr. A. G. Manley as manager.

Trade Publications

Pneumatic Tools—Bulletin No. 34F issued by the Chicago Pneumatic Tool Company, being a mechanical description of the design and construction of class G. Chicago pneumatic compressors.

Eye Comfort System—A bulletin has just been issued by the National X-Ray Reflector Company of Chicago, dealing with the use of indirect illumination in churches. The subject is treated in an interesting way and is splendidly illustrated.

Synchronous Motors.—Pamphlet issued by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., describing and illustrating Westinghouse synchronous motors, type G, 60 cycle, two and three phase, voltages 240 to 2,400, h.p. 30 to 250.

Economy Fuses—Booklet issued by the Economy Fuse and Manufacturing Company, descriptive of their renewable cartridge fuses. It is claimed that in mechanical strength, positive electrical contacts, permanence and electrical performance, the Economy renewable cartridge fuse is superior to all other designs of cartridge fuse that have been developed.

Motor Converters.—Pamphlet No. 208, issued by Bruce, Peebles & Company, of Edinburgh, descriptive of Peebles motor converters. This pamphlet is being distributed by Roper, Clarke & Company, Room 422 Coristine Building, Montreal, Canadian agents for the Edinburg company. This pamphlet describes briefly the difference between former and present sub-station practice and explains fully the principle of the motor-converter and its general design and construction. Motor-conveters for various types of work are explained.

Electrical Superintendent

WANTED for large paper manufacturing plant in the Province of Quebec; must have good references, experience, ability in handling men, and executive capacity. Apply, stating salary required, references, and full details, to Box No. 703, Canadian Electrical News office.

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Tapes and Webbings
for
Electrical Work
Write for Samples and Prices
Hope Webbing Company
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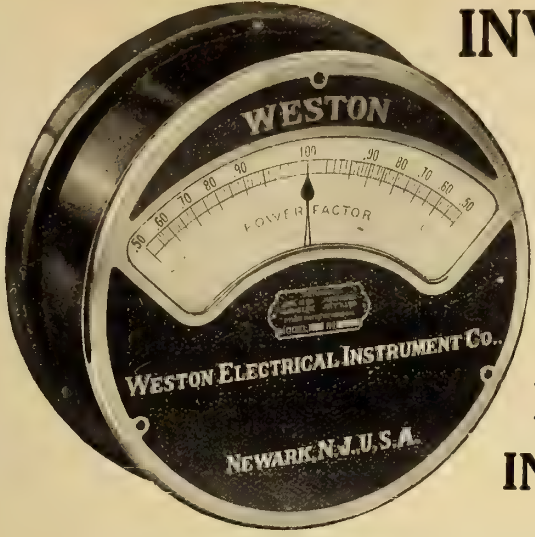

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We invite full inquiry into the merits of **Weston Power Factor Meters** and **Frequency Meters** and also **Wattmeters, Synchroscopes, Ammeters and Voltmeters** for Switchboard service on alternating current circuits.
Send for catalogs and advise us the kind of instruments in which you are interested, whether for alternating or direct current service.

Demonstrations of the operative characteristics of these remarkable instruments may be observed in our New York Office and also in the offices of Selling Representatives in Philadelphia, Chicago, San Francisco and Toronto

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Chicago, 1504 Monadnock Blk.
Boston, 176 Federal Street.
Philadelphia, 342 Mint Arcade.
Birmingham, Brown Marx Bldg.
St. Louis, 915 Olive Street.

Denver, 231 15th Street.
San Francisco, 682 Mission St.
Cleveland, 1729 E. 12th Street.
Detroit, 44 Buhl Block.
Toronto, 76 Bay Street.

Montreal
Winnipeg
Vancouver
Calgary
} Northern Electric &Mfg. Co.
Mexico, 2a Capuchinas 40.
Paris, 12 Rue St. George.

London, Audrey House,
Ely Place, Holborn.
Berlin, Genest Str. 5, Schoenberg.
Johannesburg, So. Africa,
F. Peabody Rice, Standard Bank Building, Harrison St.

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Hydro-Electric and Railway Engineers in all parts of the world are installing Feeders of

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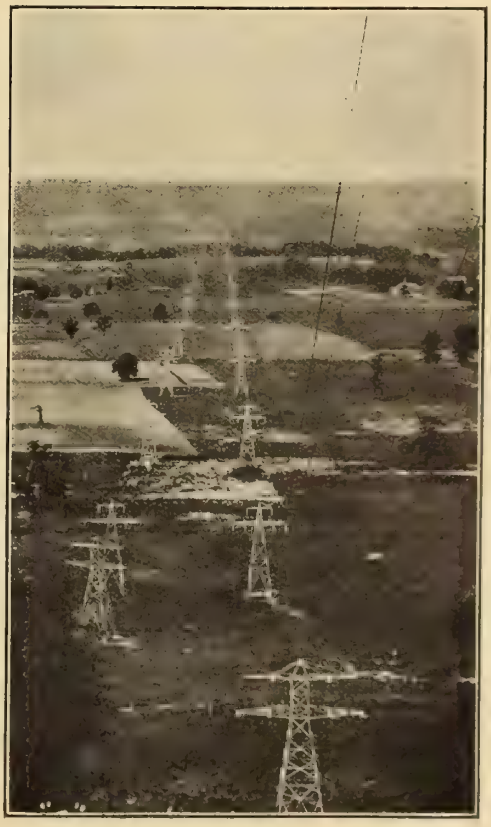

Condensed Department

RATE

Positions Wanted
Positions Vacant
Miscellaneous.
} 2 cents a word per insertion.

Tender advertisements, equipment for sale, etc., 15 cents per agate line (14 agate lines make one inch) per insertion.

Advertisers who wish to conceal their identity may do so by using an Electrical News box number without extra charge.

Forms close on the 18th of each month.

For Sale

FOR SALE—Two 27-in. Victor turbines, 400 h.p. under 30 ft. head. In excellent condition. Cheap. Address Box 202, Massena, N.Y. 3

Patents and Patent Law

Patents and Patent Law.—"Trade-Marks and Trade-Mark Law."—Send for these two free books. Advices free. Jas. E. Dodge., Dept. 14, 908-914 G St. N.W., Washington, D.C. 3-4

Car Ventilating Systems

The Vacuum Car Ventilating Company has commenced manufacturing Mechanical Car Ventilating Systems under Canadian Patent No. 128070, dated September 13, 1910, and is prepared to furnish same on demand. For detailed information and prices, address Lock Box No. 25, Windsor, Ont. 10-t.f.

Hydro-Electric Power Commission of Ontario.

Tenders for Transmission Line Material

Sealed tenders, addressed to the undersigned and endorsed "Tender for Galvanized Steel Towers, Special Crossing Towers, Copper Cable, Aluminum Cable, Insulators, Galvanized Malleable Iron Clamps, Galvanized Pressed Steel Clamps" will be received at this office until noon of **Monday, March 17th, 1913**, for the material required in construction of about 125 miles of transmission line to operate at 110,000 volts as follows:—

Galvanized Steel Towers.
Special Crossing Towers.
Copper Cable.
Aluminum Cable.
Insulators.
Galvanized Malleable Iron Clamps.
Galvanized Pressed Steel Clamps.

Plans, specifications and form of contract can be seen and form of tender obtained at this office. Tenderers will conform to the usual guarantee and provide details of address, etc.

The Commission does not bind itself to accept the lowest or any tender.

HON. ADAM BECK,
Chairman Hydro-Electric Power Commission,
709 Continental Life Bldg.,
Toronto, Ont.

Unauthorized insertions in newspapers will not be paid for.

Toronto, January 24th, 1913. 3

Situations Vacant

WANTED—First-class electrical salesman experienced in selling panel boards, switchboards, meters, transformers, etc. Splendid position for good man. Apply Box 695, Electrical News, Toronto, Ont. 3-4

Armature winder with wide experience on modern electrical apparatus, for repair work. Highest wages paid. State experience to Box 696, Electrical News, Toronto, Ont. 3-3

Situations Wanted

Electrical Engineer, McGill graduate, seven years' experience with steam, hydraulic and internal combustion generating plants, operation and construction, wishes position as superintendent of power system or with consulting firm. Will go anywhere but prefer British Columbia. Salary $2,000 per annum. Reply Box 666, Electrical News, Toronto, Ont. 1-3

Position wanted by young electrical draughtsman with some experience in sub-station layout and operation. Good technical education. Best references. Apply Electrical, P. O. Box 2727, Winnipeg, Man. 3-4

An electrical engineer with college training and seven years varied practical experience, desires a responsible position with a firm of contractors or manufacturers. Installation and repair work a specialty. Box 699, Electrical News, Toronto, Ont. 3

Position as Hydro-electric Power House Superintendent of small plant or assistant in larger plant. Ten years practical experience in care, maintenance and operation of power house and sub-station apparatus. Good technical education. Associate A. I. E. E. Best references. Box 659, Electrical News, Toronto, Ont. F

CITY OF REGINA, SASK.

REGINA MUNICIPAL RAILWAY.

TENDERS

FOR

TRACK and TROLLEY MATERIAL

Sealed tenders registered, and clearly marked on the outside of the envelope "Tenders for the Supply of Street Railway Materials," and addressed to the City Commissioners, Regina, Sask. Canada, will be received up to noon **Monday, the 24th day of February, 1913**, for the supply of:—

CONTRACT D.

1100 long tons street railway steel 7-in. Tee rails, Lorain section 80/335.
1550 pairs 6-hole 26-in. splice bars for Lorain rail section 80/335.
1040 long tons street railway Tee rails, 60 lb. A.S.C.E. section.
2000 pairs 4-hole 24-in. angle bars for 60 lb. A.S.C.E. steel rails.
10000 track bolts and nuts, 3½-in. x 1-in., oval heads, hexagon nuts.
9000 track bolts and nuts, 3¾-in. x ¾-in., oval heads, hexagon nuts.
split lock nut washers for 1-in. track bolts..
10000 split lock nut washers for ¾-in. track bolts.
660 kegs (each keg 200 lbs.) standard railroad spikes, 5½-in. x 9/16-in.

CONTRACT E.

5400 4/0 standard copper rail bonds, 10 ⅛-in. C.C.
3600 4/0 standard copper rail bonds, 13-in. C.C.
630 4/0 solid copper rail bonds, 62-in. C.C.
60 4/0 solid copper rail bonds, 72-in. C.C.

CONTRACT F.

10000 standard sawn square B.C. fir railroad ties, 6-in. x 8-in. x 7 ft.
35000 standard sawn square B.C. fir railroad ties 6-in. x 8-in. x 8 ft.
1250 Western cedar poles, 30 ft. long, 7-in. top.

CONTRACT G.

20000 barrels Portland Cement.

CONTRACT H.

21 miles 2/0 hard drawn trolley wire.
12 miles 4/0 D.B.W.P. 19 stranded copper wire.
4 miles 2/0 D.B.W.P. 7 stranded copper wire.
10 miles 3/8-in. stranded soft drawn iron wire.

CONTRACT J.

Insulators, Hangers, Brackets, Pullovers, Turnbuckles, Trolley Frogs, Crossovers, Clinch Ears, Pole Line Hardware, etc., etc.

All material to be delivered F.O.B. Regina, Freight and duty PAID.

Copies of specifications, schedules, delivery dates, and form of contract, and other particulars can be had upon application to H. Doughty, Superintendent, the Regina Municipal Railway Regina, Sask., Canada.

Persons tendering are notified that tenders will not be considered unless made on forms supplied. Forms will be mailed upon request to the Superintendent.

A marked cheque covering five per cent. (5 p.c.) of the amount of the bid (made payable to the City Treasurer) must accompany each tender.

The City Commissioners reserve the right to reject any or all tenders.

R. MARTIN, Mayor.
G. A. MANTLE,
L. A. THORNTON,
City Commissioners.

"EUREKA" Electric Suction Cleaner

The best and most practical Vacuum Cleaner ever invented, barring none, regardless of price. The Eureka is equipped with the famous Eureka type Motor that has been known for its remarkable perfection for years. The wheels on the nozzle, exclusive with the Eureka, make the machine very easy to operate. Send for sample and be convinced. **Retail Price $45.00**

Illustrated Circular and discounts upon request

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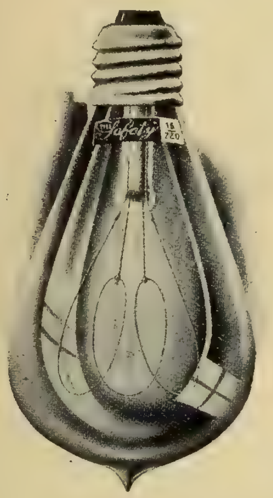

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Immediate delivery. American shapes. An awfully good lamp. Send for a trial lot, at case lot price.

Carbon Lamps

The same lamp we have always handled. We couldn't improve on the quality if we tried. The price is also right.

Other Agencies

Hotpoint Electric Irons, etc., Rollinson Bell Ringers, Transformers and Rectifiers, Cutter Flush Switches, Plates and Receptacles, "Brookduct" (Circular Loom), Prismatic Shades. Switch Boxes, Fuses, etc. Stromberg Electric Time Clocks and Cost-Keeping Machines.

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Large stock ; prompt shipments.
Write for new and complete catalogue No. 3.

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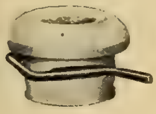

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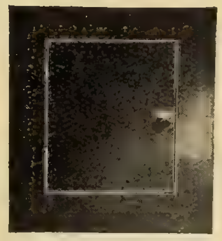
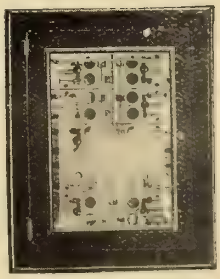
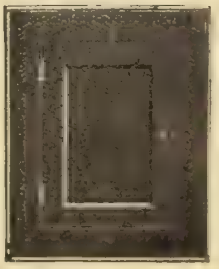


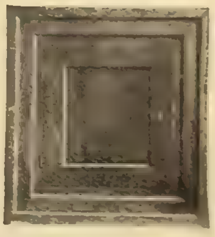
Type P. A cheap box with a door and trim.



Type C. A better one beaded and paneled.



Type G. With a beveled plate glass panel in door.



Type SW. Steel, with natural oak, mahogany or walnut finish.

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Lower Priced. Get Acquainted Now. Write: COLUMBIA, 226 E. 144th ST., NEW YORK

The MAN of the HOUR

He TELEPHONES instead of writing, walking, or riding, whenever he can, therefore saves energy and doubles his efficiency.

The more subscribers can be induced to telephone the greater will be the demand for your service and new contracts.

The better the telephones, the greater inducement to use them, and the better the service, the greater the need of it becomes. Here is where really fine equipment is the best possible directory builder.

The telephone today is not used but a fraction of what it will be a few years hence. Therefore, the better the apparatus (which means better service), the faster will its use spread.

Thousands of wasted steps are taken daily; thousands of pounds of shoe leather worn out uselessly, and what is perhaps the most important of all, hours of valuable time are thrown away; 90 per cent of which can be saved by telephoning.

Kellogg exchange apparatus is the equipment of the hour, and our continued effort is that it shall always be the best, for the best is the cheapest for exchange managers every time.

KELLOGG SWITCHBOARD & SUPPLY COMPANY

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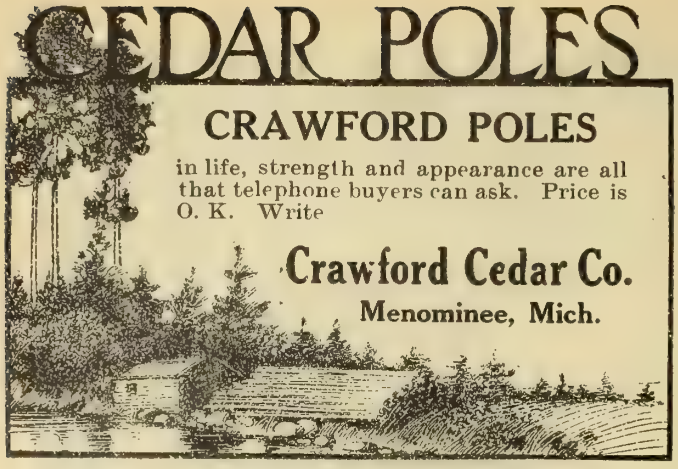

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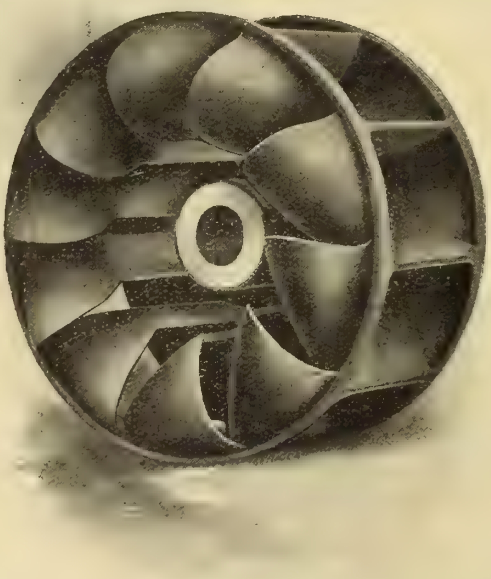

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Conserve the Water Powers.

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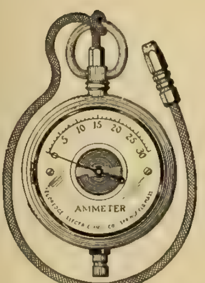

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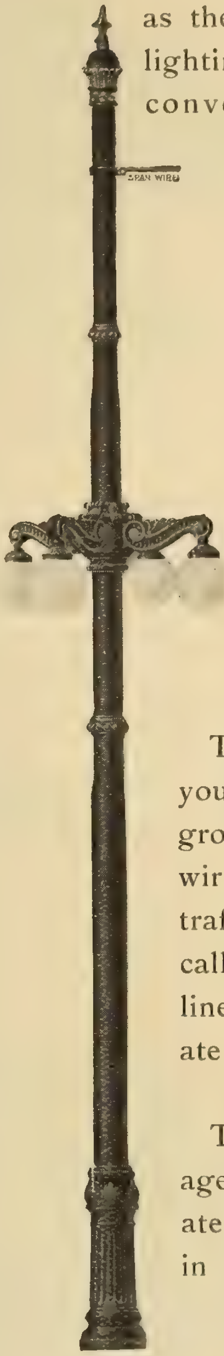

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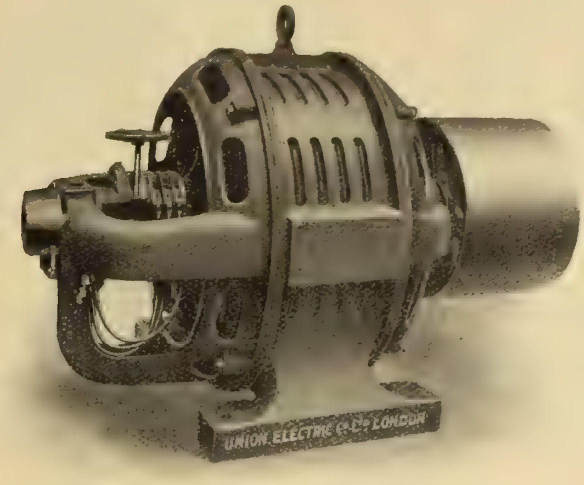
Union High Efficiency Motors for Hard Wear

We manufacture motors that carry the highest guarantee for good work under severe conditions—namely the unqualified recommendation of every user.

The Union Polyphase Motor has given the greatest satisfaction in efficiency, economy and dependability wherever used.



In all cases where it has been subject to unusually hard tests of endurance it has proved its worth by giving perfect results.

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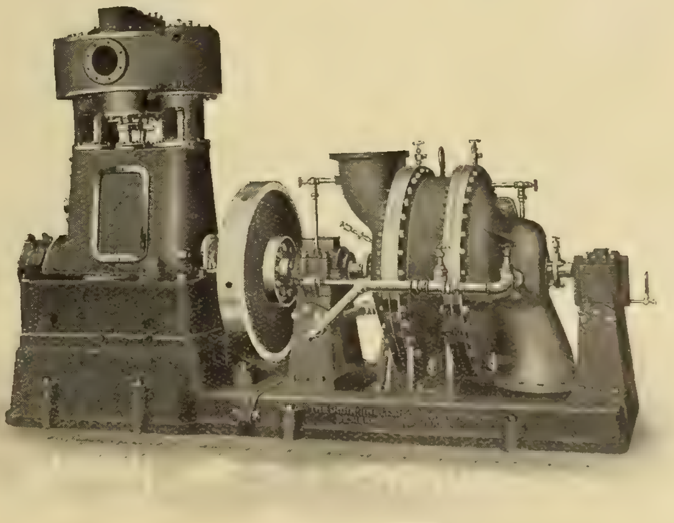
"Inglis" Turbine Pumps



"INGLIS" Pumps are the first choice of both Engineer and Owner, where High Quality, Efficiency, and Economy are considerations—Write us for Photos, Prices and other information

The John Inglis Company, Limited Engineers and Boiler makers
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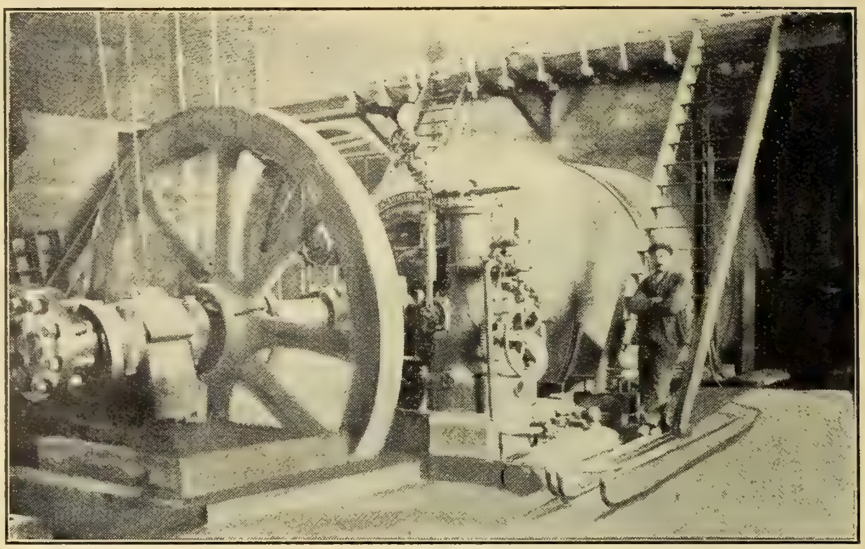


The illustration shows one of the two 3,750 B.H.P. Turbines and Oil Pressure Governor Supplied to the Calgary Power Co.

Turbines

and

Governors

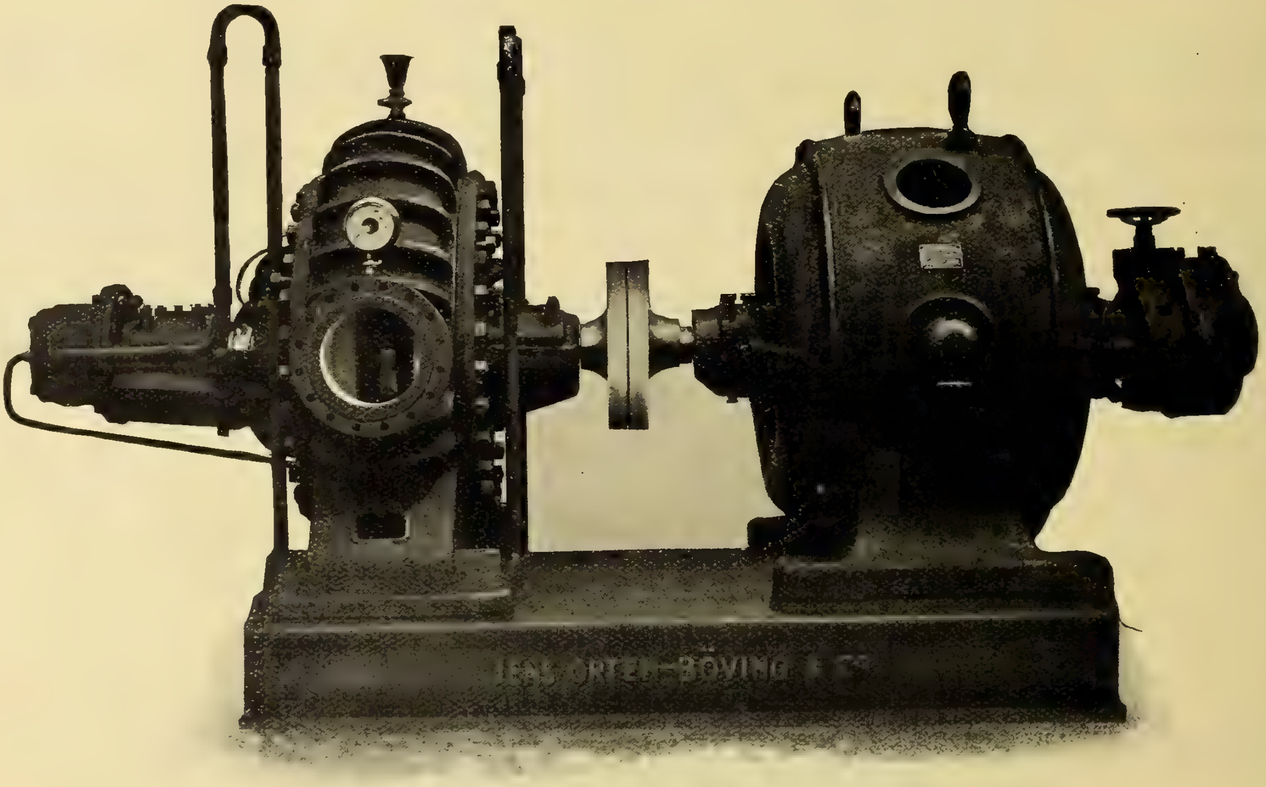
Seven Different Sizes of Governors Made

Suitable for All Conditions

No Racks No Gears

Absolutely Self Contained

TURBO PUMPS FOR HYDRAULICING



The pump illustrated was installed by the Nipissing Mining Co. for sluicing purposes. A hill of gravel and stones being sluiced off the rock by means of a high pressure jet produced by this pump.
HEAD 415 FEET—CAPACITY 4,000 IMP. GALS. PER MIN.—710 B.H.P.

For Further Particulars Apply to

The Canadian Boving Company, Limited

PIPE

164 Bay Street, TORONTO
Vancouver Office: 448 Seymour St.

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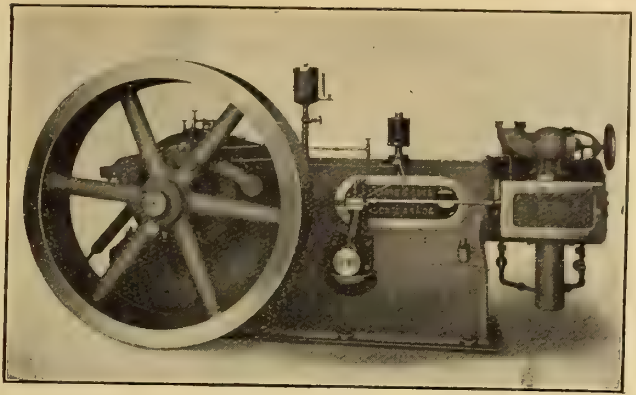

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BOILERS — HEATERS — PUMPS
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E. Leonard & Sons, London, Can.

AGENCIES: St. John, N.B. Montreal Toronto
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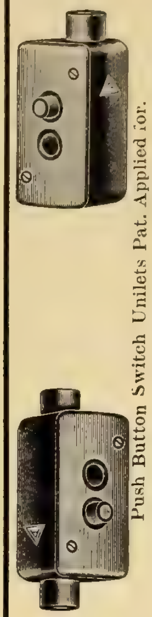
Neat Light Strong Roomy Time Savers

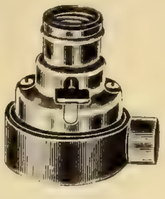
Appleton's New Drawn Steel Unilets

[Sherardized or Black Enamel Finish]

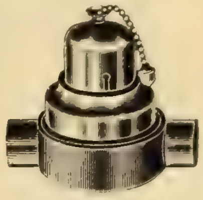


Push Button Switch Unilets Pat. Applied for.

Made of No. 14 guage cold rolled steel—practically unbreakable. The most modern conduit fittings. Made for open work conduit wiring. Let your workmen use them just once—they will ask for them always thereafter.

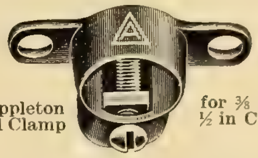


Type No. 1 with key receptacle attached.



Type No. 2 with pull socket attached.

Snap Switch Unilets, Pat. Applied for.



New Appleton Ground Clamp for ⅜ in. and ½ in Conduit.

Rectangular Unilets. Made in all types and sizes for ½ in to 2 in conduit

Everyone doing conduit work should have our new catalog. Write at once.

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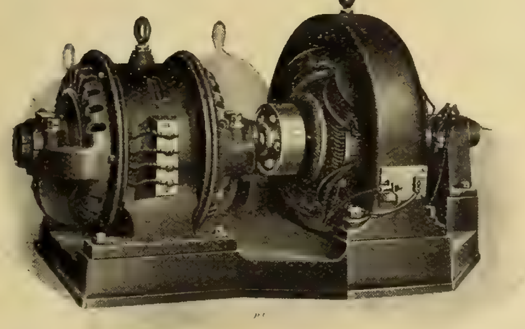

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Made in Crystal, Green and Amber

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It will pay you.

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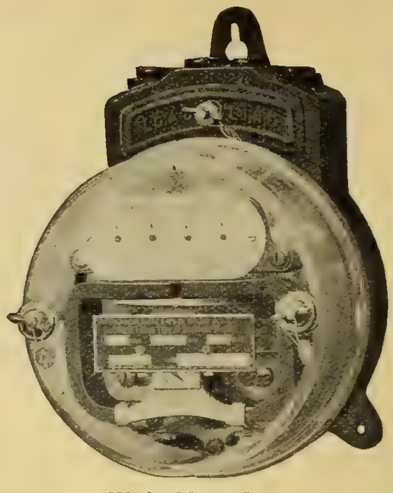
Permanent Accuracy
and
Initial Accuracy



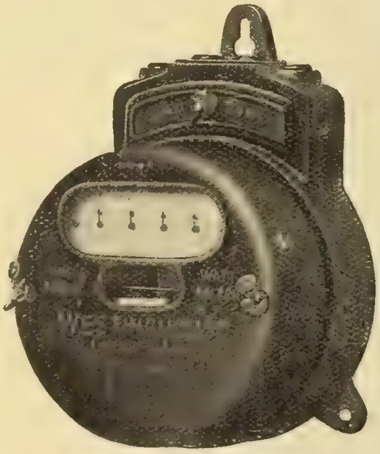
With Glass Case

There are various makes of induction type Watthour meters which satisfy the modern test requirements of initial accuracy. But, have you considered the value of your meters after they have been in service for a year or more? The meter which remains in calibration the longest time, and the meter which requires repairs or replacement of parts least often is the cheapest in the end, because it combines the least loss of revenue from accuracy errors, the least cost of service tests, and the least cost of laboratory repairs.

Westinghouse Type C Watthour Meters

have been developed and improved always with the fact in mind that long life accuracy and low cost of maintenance are features of equal importance to initial accuracy.

Ball Bearings as developed for Westinghouse Type C meters represent the lowest factor of increasing friction in service and have practically an unlimited life. The gear trains are so nearly frictionless after years of service that only by delicate devices can any load be determined.



With Metal Case

The Additional Features of slow disc speed, slow speed worm, and high ratio of torque to weight are also distinctive of Westinghouse design.

All of these features combined allow Westinghouse Type C meters to be left in service a longer time between periods of checking than is possible with any other meter. The cost for jewels is negligible. Type C meters can be dismantled sufficiently to replace electro-magnets, inspect or replace top and bottom bearings, and be reassembled ready for test, in twenty minutes or less by any meter tester.

Canadian Westinghouse Co., Limited, Hamilton, Ontario

Toronto	Montreal	Ottawa	Halifax	Winnipeg	Calgary	Vancouver
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1—½ h. p. 230 V. 850 R. P. M. Rochester Electric Co.	"
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DIRECT CURRENT DYNAMOS

1—160 light 125 Volt Westinghouse Generator with switchboard	Rebuilt
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2— ¼ h. p. 60 Cycle 110 V Single Phase Emmerson Motors	New
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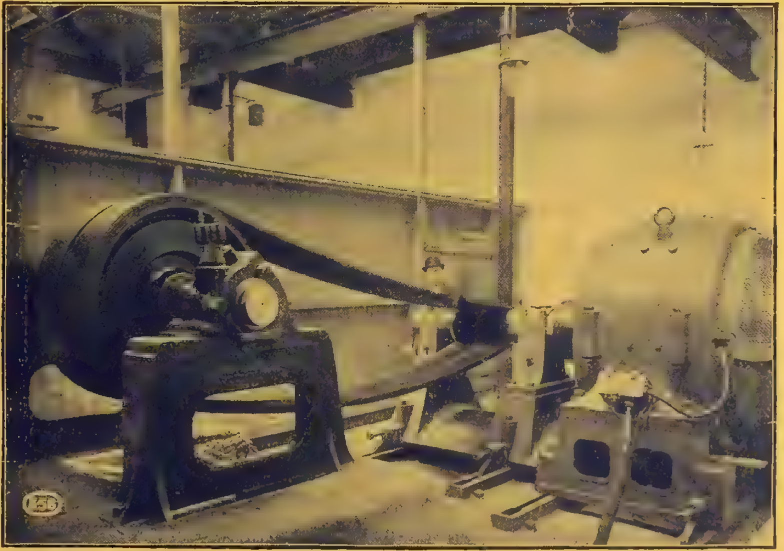
AND REMEMBER We have the Best Equipped Repair Dept. in the Province.

The Electrical Maintenance & Repairs Co., Ltd.

Long Distance Phones Adelaide 902-903 **162 Adelaide Street West, TORONTO**

Renold Patent Silent Chain Drives



180 H.P. Renold Chain drive from Motor to Lineshaft in Textile Plant

98.2% Efficiency

Absolutely Reliable

Write for particulars

JONES & GLASSCO, Engineers, (REGISTERED) **Sole Canadian Agents** **MONTREAL**

We stock Chain and Repairs

We can keep you running while we make your repairs.

Our repairs will keep you running satisfactorily afterwards.

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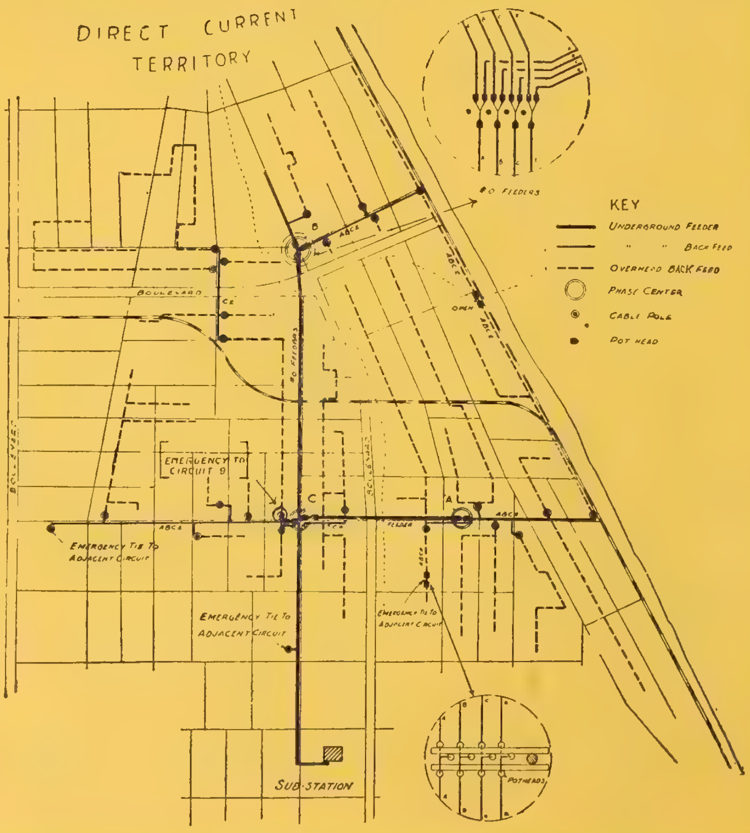
MOTORS,
ARC LAMPS, Etc.

WE HAVE THE LARGEST STOCK IN CANADA



Save Your Time

NO cutting and re-splicing of cables to locate trouble on this circuit. Drawing shows actual circuit arrangement where G & W POT HEADS are used. Highest degree of practicability and reliability for cable-seals and emergency switching.

Write for Catalog No. 7. It gives detailed information.

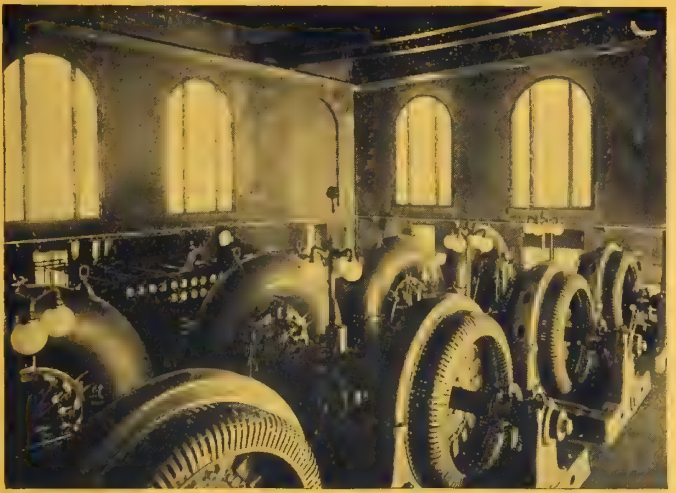
G & W Electric Specailty Co.

6308-10 Washington Ave., CHICAGO

Vol. XXII—No. 4 Toronto, February 15, 1913

Electrical News

Generation, Transmission and Application of Electricity



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Power house of the Metropolitan Water and Sewerage Board, Clinton, Mass. (now owned by City of Boston), where we have four hydraulic turbine units, each of 1600 Horse Power, under 100 ft. head, in constant operation. Turbines designed for heads from 5 feet to 600 feet.

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For the same money that you now pay for current for the old-style carbon lamp, you can have your choice of

3 times as much light in each room—or
3 times as many rooms lighted—or
3 times as many hours of light

if, instead of the carbon lamp, you use

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Canadian General Electric Co., Limited

Head Office: TORONTO

Montreal Halifax Ottawa Cobalt South Porcupine Winnipeg Calgary Vancouver Victoria Nelson Prince Rupert

Alphabetical Index to Advertisers, Page 8

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Railway Feeder and Trolley Wire.

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Incandescent and Flexible Cords.

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Branches: HALIFAX TORONTO WINNIPEG VANCOUVER

The Best Selling Electrical Specialty on the Market

Smallest Plug

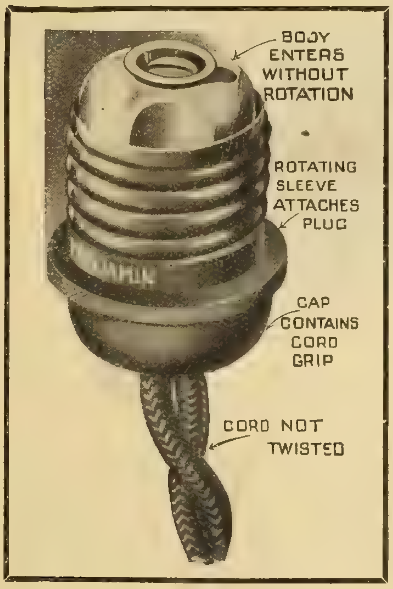
Unbreakable

No Twisted Cord

Cap Cord Grip

Universally Used

Sold Everywhere



Smallest Plug

Unbreakable

No Twisted Cord

Cap Cord Grip

Universally Used

Sold Everywhere

9-0-3

Benjamin No. 903 Attachment Plug is the most widely known specialty sold in years. It merits this proud distinction because it has stood the test of use and time.

IMITATED BUT NEVER EQUALLED

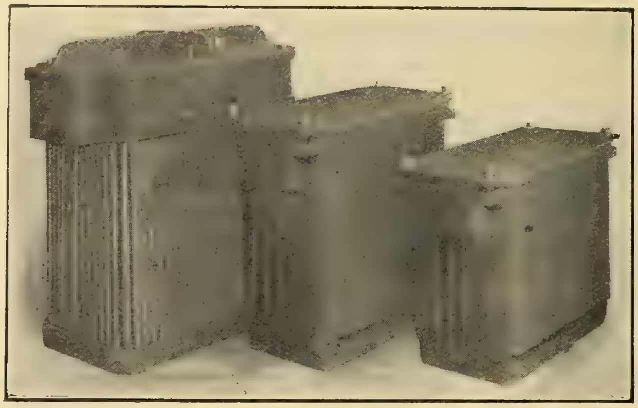
Order from your jobber

Benjamin Electric Mfg. Co.

of Canada, Limited
11-17 Charlotte St., TORONTO, ONT.

FERRANTI

Transformers



Three Phase Pole or Station Transformers

THREE phase pole oil immersed transformers have been proved the most satisfactory and efficient type. They effect a great saving in construction costs and reduce operating costs to a minimum.

In Ferranti high efficiency transformers all coils are wound with copper of ample sectional area, thereby reducing copper losses to a minimum. They are designed along simple and substantial lines and all parts are easily accessible.

In stock at Toronto and Winnipeg for prompt delivery at special prices—

100 to 300 Lamp Oil Switches
Motor Starters
Ammeters and Voltmeters
Portable Power Factor
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Write us for particulars

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Steel Case—Top or Bottom Connections

IF you are in the market for electric meters it will pay you to secure prices and particulars for Ferranti meters. They have many points of merit.

Simplicity of construction.
Perfect accuracy.
Cyclometer or clock dials.
Top or bottom connections.
Prompt deliveries.
Every meter carefully inspected before shipment.
Absolutely guaranteed.
Send us your probable meter requirements and let us make you a proposition.
Large stock and fully equipped repair and erection Shops at Toronto and Winnipeg.

The Ferranti Electrical Co. of Canada, Ltd.

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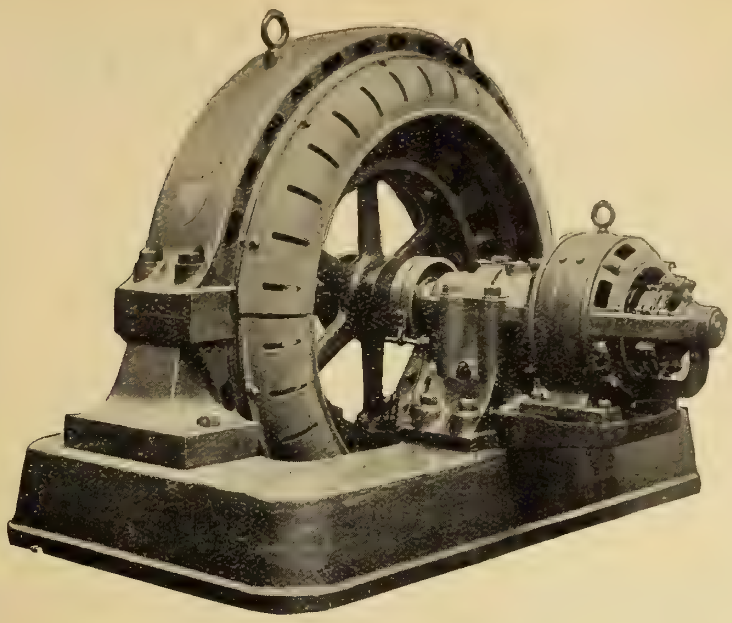

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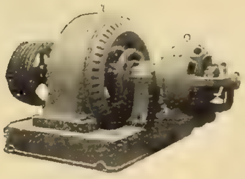
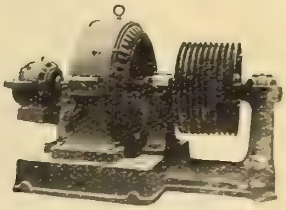
FOR THE COLONIES

ALTERNATORS

CANADIAN AGENTS
Federal Engineering Co., Limited
Montreal Toronto Winnipeg Vancouver





FEDERAL PAYS THE FREIGHT

on Tungsten lamps in case lots to the following cities:—Hamilton, Toronto, Peterboro, Ottawa, St. Catharines, Montreal, Quebec. Halifax, St. John, N. B., Winnipeg, Man.

Firms contracting for Tungsten and Carbon lamps should get our prices before closing contracts.

Fedram Wire Drawn Tungsten Lamps

are built to the most rigid specifications as to

Efficiency
Durability **Life**

Prices and full information mailed on request

We can make you an attractive proposition on Tungsten and Carbon Lamps

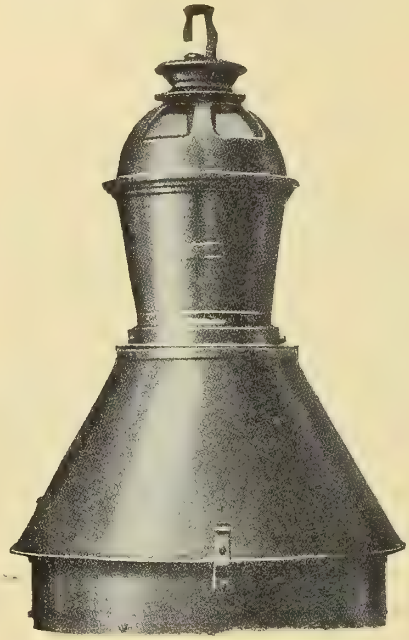
Federal Engineering Co., Limited

90 Sherbourne St.
TORONTO

Unity Building
MONTREAL

C. G. E. Color Matching Outfit

A necessity for the man whose business requires the perfect matching of colors.



COLOR MATCHING OUTFIT

INCREASE PRODUCTION by having available a Color Matching light 24 hours every day.

The spectrum of the C. G. E. Color Matching Outfit is like that from a clear north sky.

The use of the C. G. E. Color Matching Outfit removes the natural limitations imposed upon production, and "rush" orders can be accepted with the assurance that the colors can be properly matched at any time of the day or night, because the light is unchanging and the manufacturer is enabled to maintain the highest grade of uniformity in the process of color matching.

It is Simple
Inexpensive to install
Economical to Maintain
Requires no more attention than any ordinary arc lamp

TURN a switch and you have available a light perfect for the matching of colors.

This device is indispensable to textile mills, pulp mills, dye works, lithographers, manufacturers of dye stuffs, department stores and in fact any establishment whose output is dependent upon the proper matching of colors.

The outfit is very simple and consists primarily of an intensified arc lamp with a special casing and a combination of a diffusing and several absorption glasses. The function of these glasses is to reduce the slight excess of red, orange and violet rays found in the spectrum of the intensified lamp, so that standard daylight is faithfully reproduced.

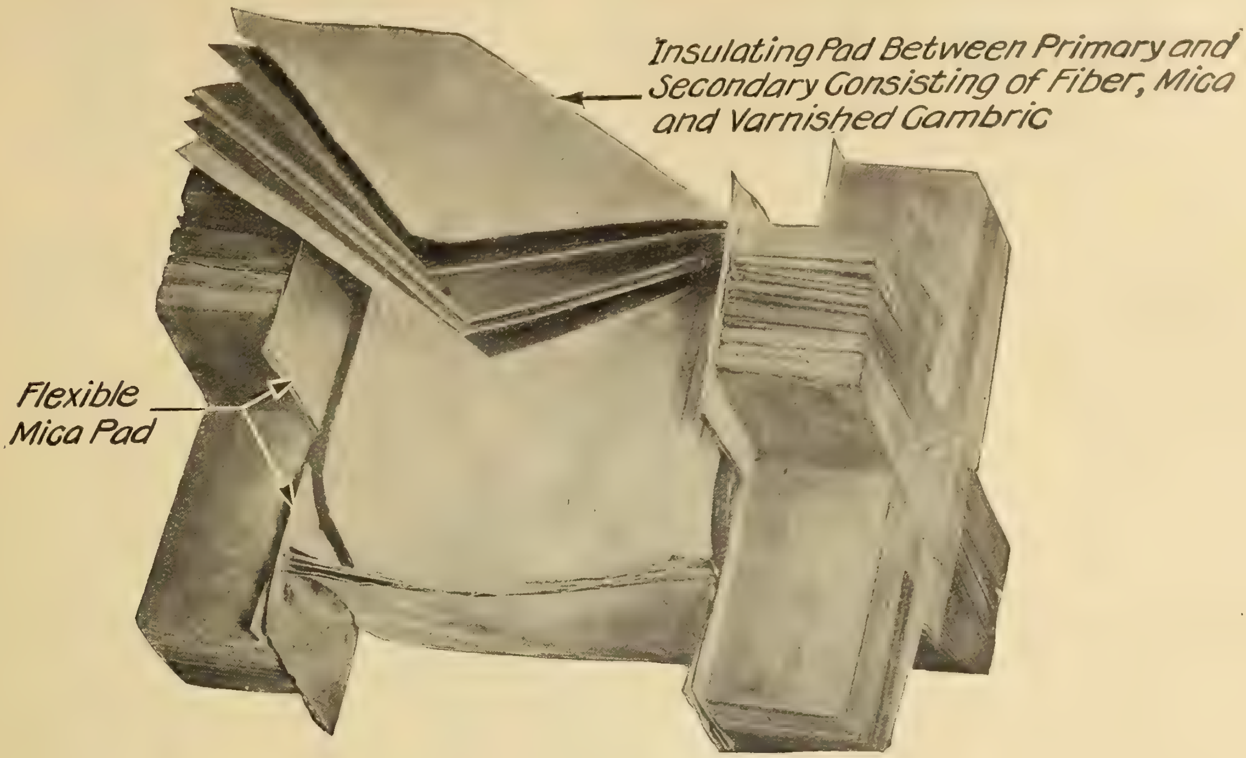
COLOR MATCHING OUTFIT
with Color Screen Lowered

WRITE OUR NEAREST BRANCH OFFICE FOR PRICES AND FURTHER PARTICULARS

Canadian General Electric Co., Limited

Head Office: TORONTO

Montreal Halifax Ottawa Cobalt South Porcupine Winnipeg Calgary Vancouver Victoria Nelson Prince Rupert


Insulating Pad Between Primary and Secondary Consisting of Fiber, Mica and Varnished Cambric
Flexible Mica Pad

Reliable Transformer Insulation

The vital parts of the Type "H" transformer are protected by composite insulations which involve the liberal use of mica.

Fibrous insulations are weakened and may be destroyed by abnormal temperatures. Mica, under like conditions, maintains its original insulating value.

Fibrous insulations tend to absorb moisture, which greatly reduces their dielectric strength, while mica, under similar conditions, is unaffected.

Fibrous insulations properly proportioned offer great resistance against momentary surges. In combination with mica, one reinforces the other, resulting in an insulation sufficient to meet every normal or abnormal condition of service.

Mica has contributed largely to the reputation of the Type "H" for permanence and reliability. When insulating material superior to mica is found it will be incorporated in the Type "H" transformer.

If you are considering transformer investments—*Look for the mica.*

The transformer of longest life.

Canadian General Electric Co., Limited

Head Office: TORONTO

Montreal Halifax Ottawa Cobalt South Porcupine Winnipeg Calgary Vancouver Victoria Nelson Prince Rupert

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The Best Endorsement of the value of the "Electrical News" as an advertising medium is the above List of Advertisers

"GALVADUCT"

Used in the Highest Office Building in the British Empire—C. P. R. Building, Toronto

"Galvaduct"

The
Most
Perfect
Interior
Construction
Conduit
on the
Market

Used
in the
Largest
Buildings
in
Canada

"Loricated"

A High
Class
Interior
Construction
Conduit
of the
Enamelled
Type

Proof
Against
Acid or
other
Corrosive
Agents

Always use "GALVADUCT" or "LORICATED" to carry your wiring and you will have protection and good service.

If Your Jobber Cannot Supply You, Write Us

Conduits Company Limited

Toronto and Montreal

The Lachute Shuttle Co., Limited

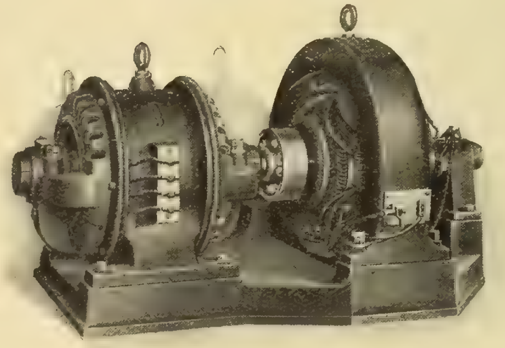
Lachute Mills—P.Q.

Manufacturers of

Cross Arms—Space Blocks—Birch and other Hardwood Insulator Pins and Brackets.

Toronto & Hamilton Electric Company

HAMILTON



MAKE

Motors for All Circuits

Dynamos for Power and Light and Electroplating

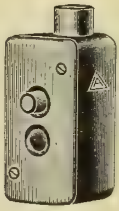
Repairs Executed Neatly and Promptly

WRITE US

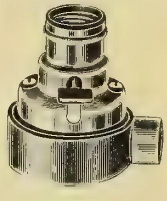
Neat Light Strong Roomy Time Savers

Appleton's New Drawn Steel Unilets

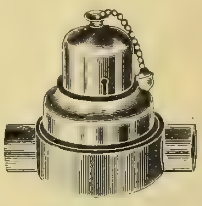
[Sherardized or Black Enamel Finish]



Made of No. 14 guage cold rolled steel—practically unbreakable. The most modern conduit fittings. Made for open work conduit wiring. Let your workmen use them just once—they will ask for them always thereafter.

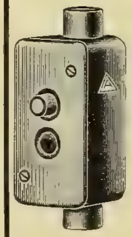


Type No. 1 with key receptacle attached.

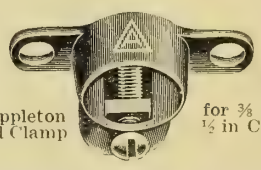


Type No. 2 with pull socket attached.

Snap Switch Unilets, Pat. Applied for.



Push Button Switch Unilets Pat. Applied for.



New Appleton Ground Clamp

for ⅜ in. and ½ in Conduit.

Rectangular Unilets. Made in all types and sizes for ½ in to 2 in conduit

Everyone doing conduit work should have our new catalog. Write at once.

APPLETON ELECTRIC CO.

212 North Jefferson St. - - CHICAGO, ILL.

FOR SALE BY

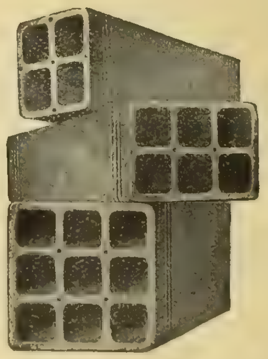
Chapman & Walker, Ltd., Toronto. The Mainer Electric Co. Ltd., Winnipeg. Marshall Wells Co. Ltd., Winnipeg Montreal Electric Co. Ltd., Montreal.

Clermont Sewer Pipe Co.

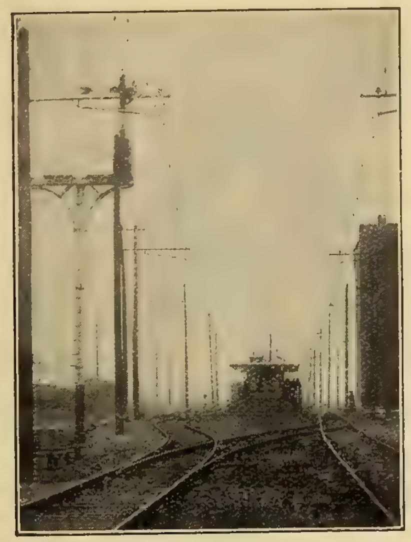
Multiple and Single Duct Conduit for Underground Work

We challenge the world on finish and durability of our material. Our plant is located giving us the lowest freight rates to Canada.

B. S. BARNARD, Vice-Pres. **50 Church St., New York City**



O-B Catenary Materials



We are prepared to give prospective customers the benefit of our experience gained by years of designing and manufacturing catenary materials and observing them in service under various conditions.

Many of the largest catenary roads in Canada and the United States adopted O-B Catenary Materials after thorough investigations and tests.

Some Points of Merit

Hangers with extruded ear and steel strap. Clinched upon trolley wire—no bolts, no screws, maximum clearance for trolley wire.

Duplex clamp for suspending steel trolley wire under copper messenger — note duplex construction on left in above illustration.

Steady strain with impregnated hickory arm and spring which takes weight of arm off trolley wire and eliminates "hard spots"

Tee Bar Pole Brackets with heavy malleable castings entirely circulating the bracket arm—the kind for long service.

Full listing on pages 7 to 56 of Catalog No. 12

The Ohio Brass Company

Mansfield, Ohio, U. S. A.

SUNBEAM

MAZDA LAMPS

Tell Your Customers

The big selling point that will "sell" ninety per cent. of your customers is, that no more current is required to light three Sunbeam Mazda Lamps than is necessary to light one carbon lamp. Three times as much light at the same cost.

Every jobber should carry a complete stock of these lamps.

Write us for prices and particulars

The Canadian Sunbeam Lamp Co., Ltd.

Main Office and Factory:
Dufferin and Liberty Streets
Toronto

Northwestern Office and Warehouse:
173 McDermott Avenue
Winnipeg

Mr. Contractor and Fixture Dealer:

Are you shaping your policy for 1913? You no doubt are anxious to promote greater efficiency and bigger profits for the year.

Time was when fixtures sold the glassware, to-day globes and reflectors influence the sale of fixtures, and have secured many a good order and fixture job for the Contractor and Fixture Dealer.

"Holophane" has always stood for a high standard of efficiency. To-day it has associated with it lines that meet the highest demands for artistic globes and reflectors.

The Holophane Co., Ltd., Toronto, are makers and distributors of the longest and strongest lines of globes and reflectors in the world. "Holophane" (Made in Canada) Iris, Veluria, Calla, Pyro, Cut and Etched, Holophane Steel and Porcelain Enamel Reflectors. Each line distinctive and a leader, one that will help build up your business.

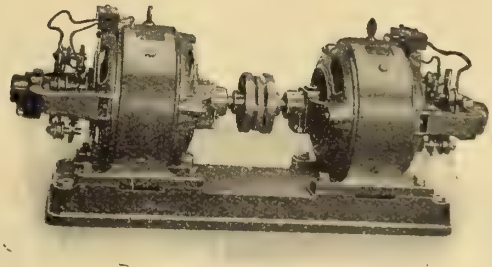
New designs in enclosed and semi-indirect units. See all these new things before deciding on next year's stock. They will help promote sales and indirectly your profits. Wait for the Holophane man.

UNION

Motor Generators for All Purposes

WE MANUFACTURE AND SUPPLY

Motor Generators for all conditions of service also a type specially designed for Cinematograph Work



Special designs executed for special requirements

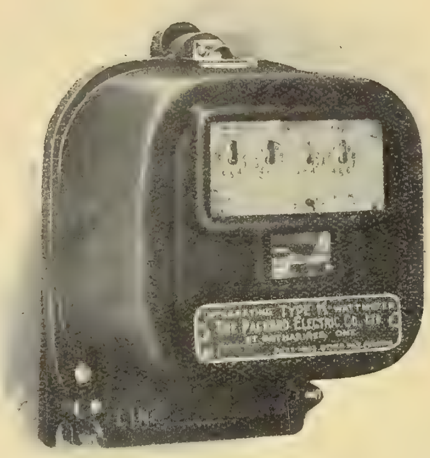
Send us your enquiries we can handle them

Flexible Coupling

Smooth Running and Reliable

Canadian Union Electric Co. Limited
122 Wellington St. West, TORONTO—Tel. Adel. 3150
9 St. Nicholas St. Montreal

Mainer Electric Co., Limited
61-63 Albert St., Winnipeg, Man.
Representatives for Manitoba, Saskatchewan, Alberta.



TYPE K METAL CASE

PACKARD METERS

For All Circuits

Always Reliable

Permanent Accuracy

Every Meter Guaranteed

TYPE PK POLYPHASE

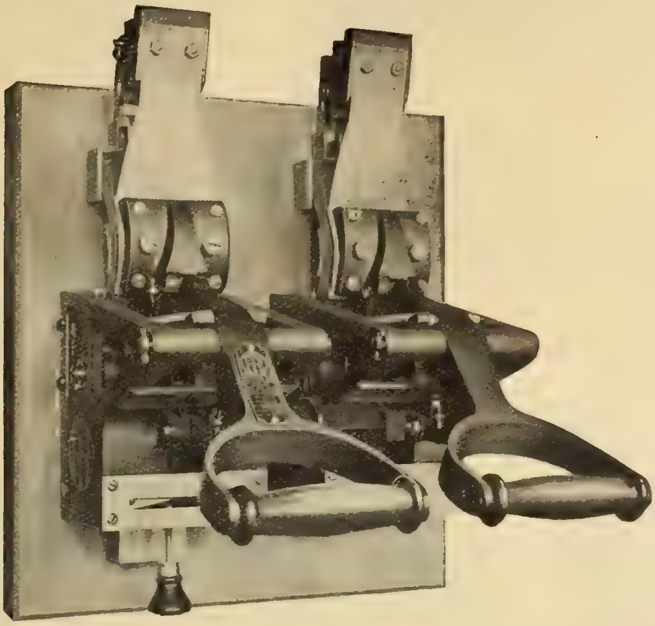
Large Stocks at St. Catharines and Winnipeg St. John Railway Co., St. John, N.B.
General Supplies, Limited, Calgary, Alta.

The Packard Electric Company, Limited

Factory: ST. CATHARINES

General Sales Office
901-902 Traders Bank Building,
TORONTO

N. W. Office and Warehouse
WINNIPEG



Consideration of

Space Economy

is often of great importance in the design of the switchboard, and this point we have borne in mind in the development of our apparatus aiming to produce for each class of service the Circuit Breaker best adapted to the end in view, embodied in the smallest dimensions consistent with satisfactory performance.

The I-T-E Dublarm

Circuit Breaker, N-X Type, illustrated at the top of the page is a striking instance of this development. It is widely used for the protection of direct current lighting and power feeders of 250 volts or less, and is also well adapted for the protection of individual motors.

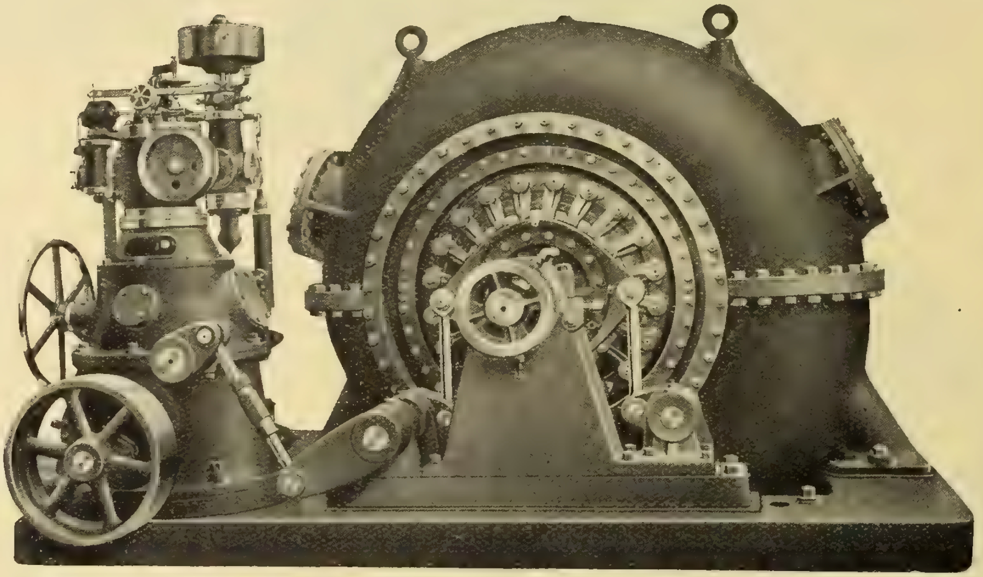
THE CUTTER COMPANY, Main Office and Factory **PHILADELPHIA**

W. C. Jessup, 120 Liberty Street, New York City.
H. F. Darby, Jr., 1501 Monadnock Block, Chicago, Ill.
H. W. MacVaugh, 1122 Park Building, Pittsburgh, Pa.
Thos. E. Beasley, 751 Ellicott Square, Buffalo, N.Y.
C. E. Wise, 427 Ford Building, Detroit, Mich.
Eccles & Smith Co., 71 First Street, San Francisco, Cal.
Eccles & Smith Co., 524 S. Los Angeles St., Los Angeles, Cal.
Eccles & Smith Co., 68 First Street, Portland, Ore.
Electric Manufacturers' Sales Co., Tramway Bldg., Denver, Col.
I-T-E Electric Co., 72 Finsbury Pavement E.C., London, Eng.

HYDRAULIC TURBINES

WITH

OIL PRESSURE GOVERNORS



Governor and Outside Gate Rigging

We design and build reaction turbines of the highest efficiency.

Our new oil pressure governor provides the safest and most sensitive regulation.

Works—Montreal

Sales Offices: MONTREAL, 613 Canadian Express Co. Bldg. TORONTO, 810 Traders Bank Bldg.
WINNIPEG 601 Builders Exchange Bldg. VANCOUVER, Dominion Bldg.
COBALT CALGARY

ALLIS-CHALMERS-BULLOCK
LIMITED

The Story of the Tungstolier

is found in convenient bulletin form, present issues being as follows:—

FOLDING	Tungstoliers	Bulletin	No. 20a
CLASSIC	"	"	No. 80
HAMMERED	"	"	No. 100a
MAZDA BOX	"	"	No. 100a
SHOWER	"	"	No. 100a
T T C	"	"	No. 110a

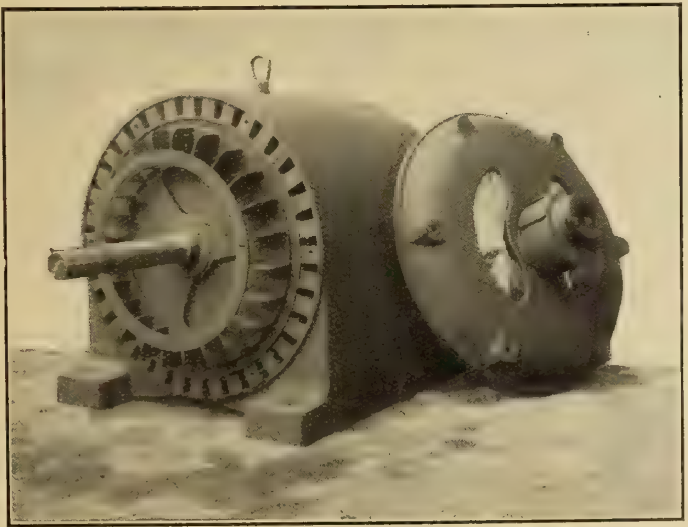
Also special designs for special purposes.

THE TRADE SUPPLIED ON REQUEST

The Tungstolier Company
of Canada, Limited
HEAD OFFICE: **212 King St. West, TORONTO**

Engineering Works of Canada, Limited

Head Offices: New Birks Building, MONTREAL, QUE.



"ENCLOSED MOTOR (showing fan for external circulation)."

Induction Motors

Enclosed Type

The capacity of the ordinary type of enclosed motors is often less than half of the corresponding open type. The patented design of our motors type "NE" embodies a radical improvement of that drawback. The capacity of our enclosed motors is only 15% smaller than the capacity of the same open type, which enables us to supply a motor of a specified rating at a cost only slightly increased over the open type.

Builders under the patents of the

Societe Alsacienne
ESTABLISHED 1826

Mechanical and Electrical Machinery

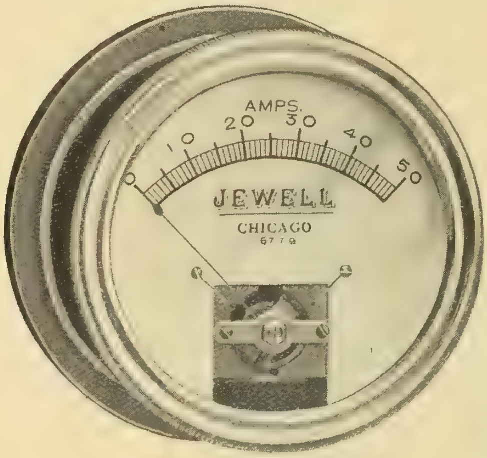
MARSHALL-DAVIS

—LIMITED—

ELECTRICAL APPLIANCES

DUNNVILLE, - ONTARIO

Agents for Jewel Electrical Company, Chicago



Precision Instruments

for

Switchboard, Laboratory,
Portable, Automobile,
A. C. or D. C.

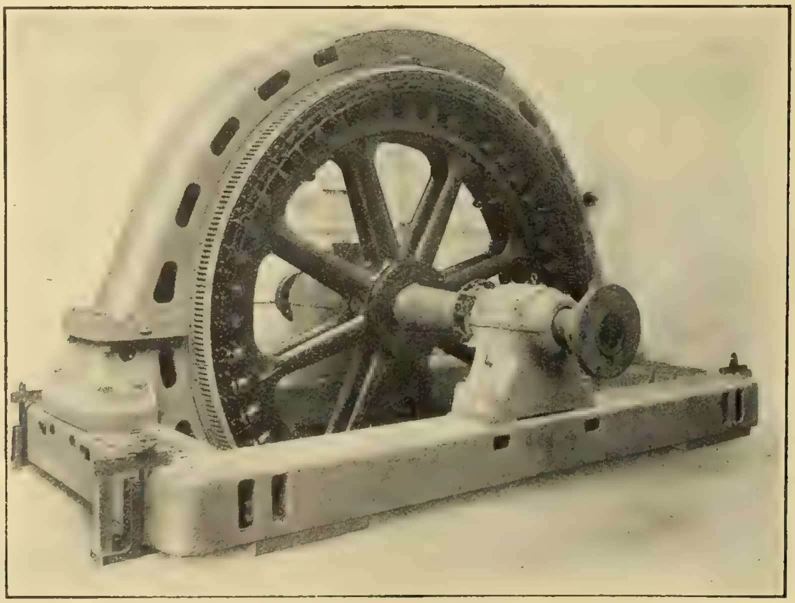
An Instrument for Every Purpose

PROMPT SHIPMENTS BROAD GUARANTEE

VICKERS LIMITED

Patent Automatic Reversing Drive for Planing Machines

Complete Equipments for the electrical lighting and driving of machine shops, factories, etc.



3000 K. W., 6600-volt, 164 R..M. 3-Phase Generator for the City of Winnipeg. Five Generators have been supplied

Turbo Generators

Motors of all types

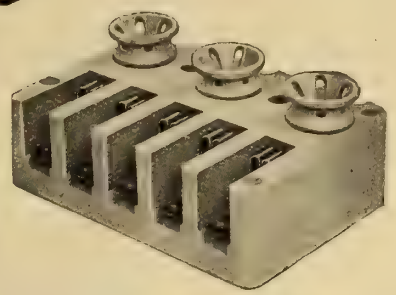
Motor Generators

Rotary Convertors

Head Office for Canada: Lewis Building, Montreal
Mr. J. F. I. Thomas (Representative)

Works:
River Don Works, Sheffield, England

MURRAY PATENTS



Standard Test and Fuse Block. Can be used on any metered service up to 30 amperes capacity.

The
Metropolitan Devices

Give

Protection to your meters,
Safety to your system and employees,
and are adaptable to any meter.

By Using Metropolitan Devices
The Central Station

Will control all service fuses.

Will safely test and change meters without interruption of service.

Will prevent theft of current.

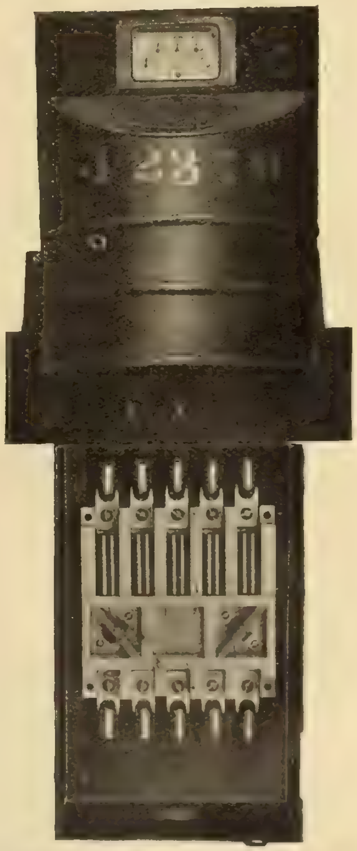
Will save from 25 to 50 per cent of meter installers' and testers' time.

Will quickly and cheaply seal services when meters are removed.

WRITE FOR PARTICULARS

Metropolitan Engineering Company

90 Sherbourne Street
Toronto - Canada



Standard Test and Fuse Block. Can be used in any metered service over 30 amperes capacity. Installed in box, cover removed and applied to Thompson meter.

MURRAY PATENTS

CANADIAN BRITISH ENGINEERING CO.
LIMITED

Successors to

The James Stuart Electric Co.

Wholesale Importers and Distributors of

Electric Supplies and Engineering Apparatus

A LARGE and VARIED STOCK carried at WINNIPEG WAREHOUSE

including :—**Wires and Cables, Conduits, Conduit Fittings and Boxes, Switches, Fuses, Cutouts, Sockets, Receptacles &c.**

Madza and Carbon Lamps
Street Light Fittings and Line Material
Telephones, Bells and Fire Alarms
Dry Cells and Secondary Batteries
Heating and Cooking Devices
Automobile Accessories, &c. &c.

OUR ENDEAVOR

is to ship standard supplies the day order received

324 Smith Street
WINNIPEG

2 Toronto St.
TORONTO

4 Queen Victoria St.
LONDON, ENG.

H. WEIDMANN, RAPPERSWIL, SWITZERLAND

Maker of PRESSPAN and INSULATING MATERIAL

PRESSBOARD (Presspan) in Sheets, Rolls and Tapes, Presspan tubes and stampings, Black Presspan.

AMIANITE (vulcanized Asbestos), **Coil Frames, Spools** for Dynamos, Motors and Transformers; Insulating Blocks, Tubes, Plates, &c.

ASBESTOS CEMENT in plates, arc shields for controllers, etc.

CORNITE (high-tension material). Handles for Switch-gear and heating apparatus, controller insulation, moulded parts of all kinds.

MICA and Substitutes, Insulating Pearls, Transformer Spools

Japanese Paper in Rolls and tapes.

Oil-varnished Linen, Diagonal Tapes. Oil-varnished Silk and Paper.

Insulators for Electric Furnaces, Tramways, &c., &c.

Our Telephones and Apparatus are Par-Excellent

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IGNITOR
DESIGNED ESPECIALLY FOR GASOLINE ENGINES MOTOR BOATS GAS ENGINES AUTOMOBILES AND GENERAL IGNITION WORK
EACH CELL FULLY GUARANTEED
MADE IN CANADA
THE Northern-Electric AND MANUFACTURING CO LIMITED
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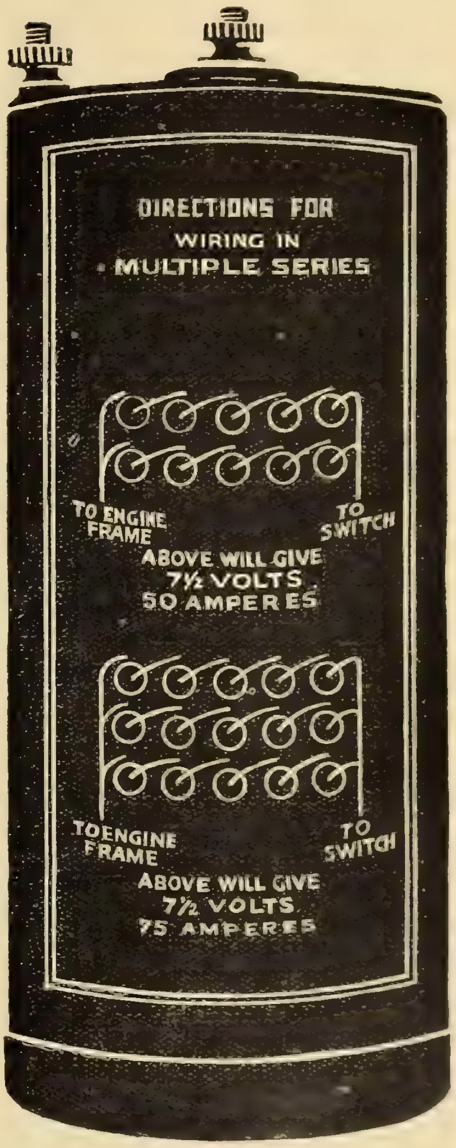
DIRECTIONS FOR WIRING IN MULTIPLE SERIES
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ABOVE WILL GIVE 7½ VOLTS 50 AMPERES
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and numerous other Electrical Appliances but space prohibits enlargeing on them in this issue.

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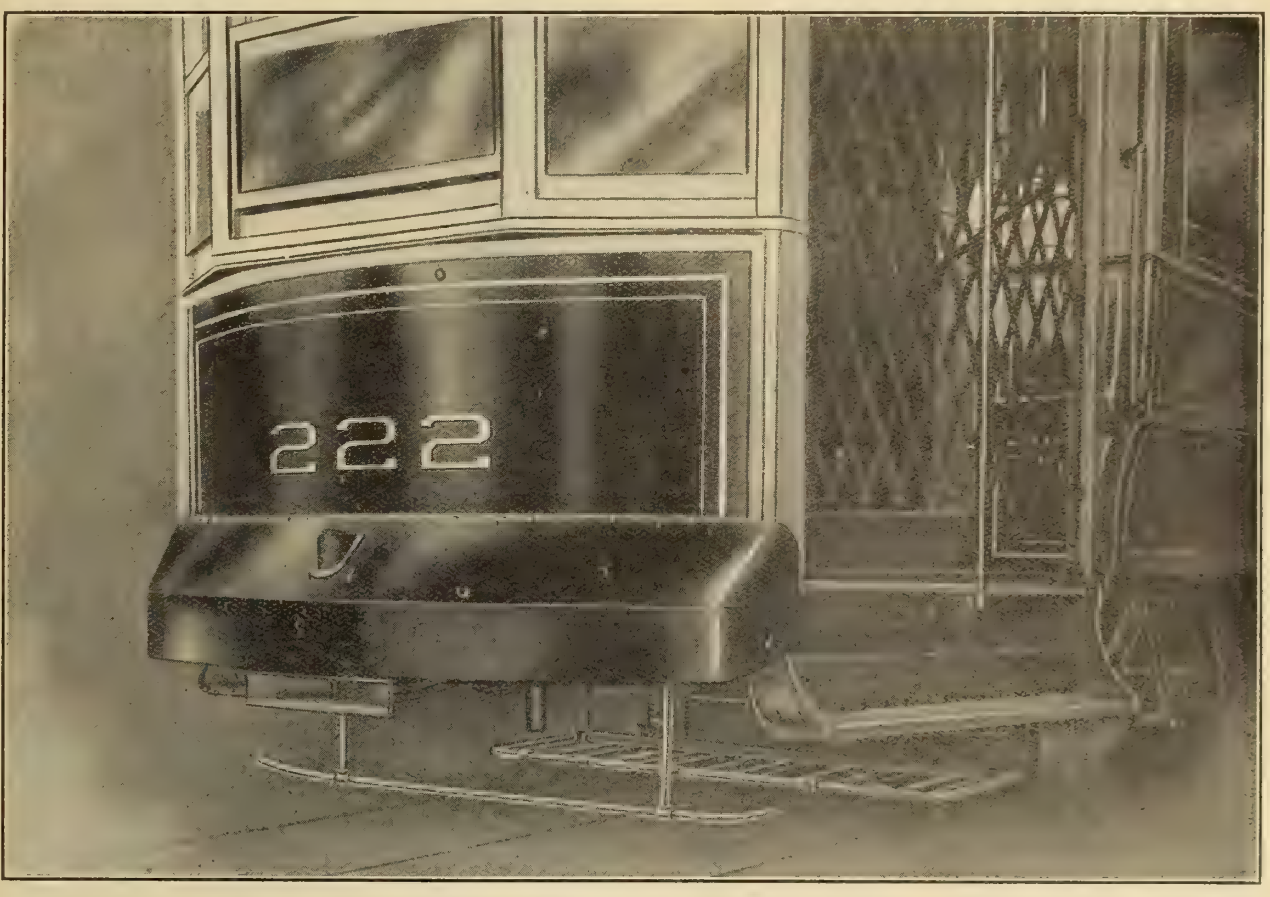

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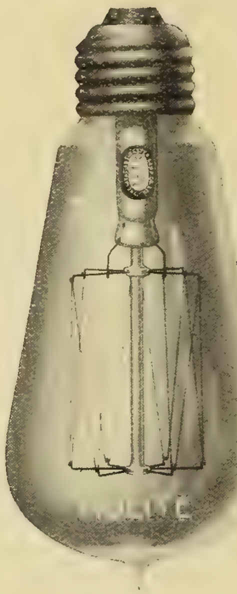

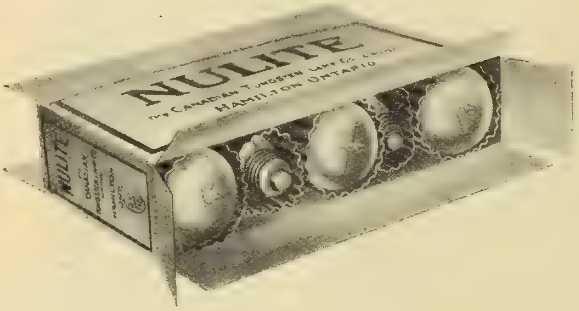
NULITE
THE CANADIAN TUNGSTEN LAMP CO. LIMITED
HAMILTON ONTARIO

NULITE
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Will stand handling like a Carbon Lamp.

Note the simple nature of the package, which however is perfectly safe owing to the hardy nature of the continuous filament used in this lamp.

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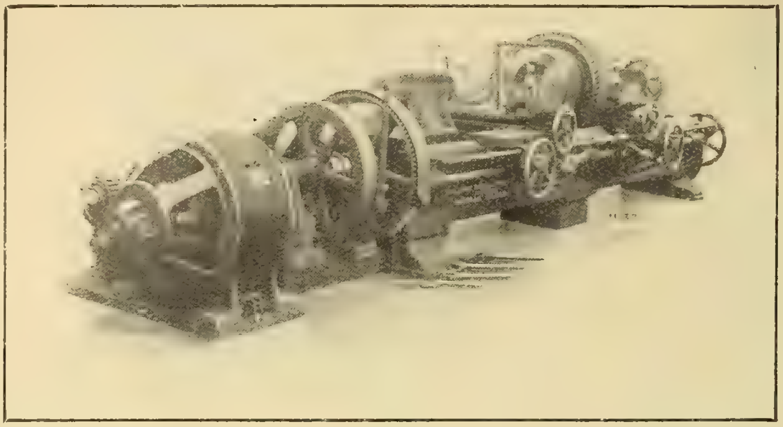

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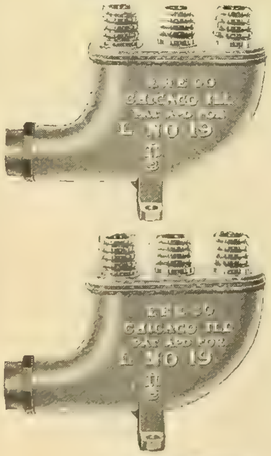

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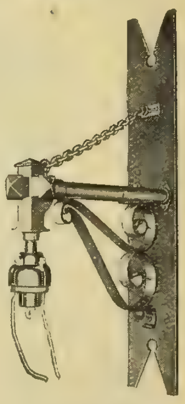

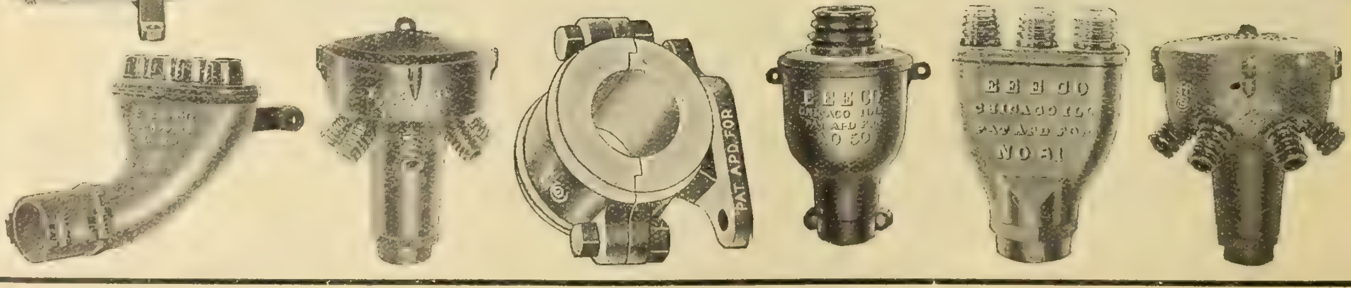

Electrical News

Generation, Transmission and Application of Electricity

PUBLISHED SEMI-MONTHLY BY

HUGH C. MacLEAN, LIMITED,

HUGH C. MacLEAN, Winnipeg, President
THOMAS S. YOUNG, General Manager.

HEAD OFFICE - - 220 King Street West, TORONTO
Telephone Main 2362

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Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Vol. 22 Toronto, February 15, 1913 No. 4

Lightning Arresters

Apparently the most important advance that has been made in recent years in the theory of high tension transmission and the difficulties surrounding it, is contained in the announcement that much of the trouble which was formerly supposed to be due to excessively high voltage is now believed to be caused by high frequencies. That is, it is now believed that whereas a high tension line may operate normally at 25 or 50 or 60 cycles, a lightning flash in the vicinity of the line may increase this number enormously to anywhere in the neighborhood of 1,000,000 cycles. Thus it would appear that the apparatus that has been designed in the past to withstand voltages of two or three times the normal working voltage of the line has not fully provided for one of the most important contingencies.

This point was brought out recently in a paper by Messrs. Imlay & Thomas, describing some experiments they had made in connection with the design of insulators for a new line. In these investigations it came out that insulators constructed and tested for a normal working voltage of 20,000 to 30,000 votls would puncture repeatedly at a much lower voltage than this when the frequency of the discharge was increased to a number comparable with that of a lightning flash. As a result of these experiments therefore, an insulator was finally designed, having in view the destructive effects of high frequency discharges rather than those of high voltage.

The present issue of the Electrical News contains an article on lightning troubles by Mr. Lofvengren in which the author speaks of the weaknesses of the average lightning arrester and maintains that a type of equipment similar in operation to an ordinary condenser is the only satisfactory means of taking care of this high frequency discharge. It is pointed out in this paper that lightning troubles are due to three causes, (a) Static charges of electricity which may set up a surge on the line and which are best cared for by some short circuiting low resistance type of equipment. (b) Lightning flashes which strike the line and which, it is claimed cause only local trouble and (c) high frequency surges, which are the result of lightning flashes taking place from cloud to cloud or from cloud to earth in a direction approximately parallel to the line. These induction high frequency surges, it is claimed, are the ones which travel considerable distances along the line, and are responsible for most of the destruction to generators, transformers, etc. For this kind of trouble the condenser type of lightning arrester is claimed to be particularly effective. The article deals with the question in a more or less mathematical way but the underlying principles may be understood without any reference to these parts.

Auburn Power Plant

In this issue we print a detailed description of the development plant of the Electric Power Company at Auburn dam in Peterborough, in which a number of unique features have been introduced. One of these is the installation of a specially designed and practically water-tight travelling sluice gate which has been provided for emptying the wheel pits for repair or examination purposes. This gate is some 15 ft. x 14 ft., constructed of riveted boiler plate, and carried by a travelling gantry constructed of structural steel and mounted on four cast iron wheels. The gate itself is fitted with circulating rollers at each side to run in the concrete stop log gains. With this arrangement the gate can be lifted or lowered under a full head of water with the turbine gates wide open. Leakage is reduced to a minimum by means of adjustable skin side-bars which serve as guides and are set into place after the gate is closed. The gate is moved along the rails by means of a hand-gear, but can be raised or lowered electrically. Even against quick running water passing through the opening, under the maximum head, this gate can be lowered or raised in about 2¼ minutes.

Another interesting departure in the design is that in connection with the transformer house. No crane has been provided here, but a door is placed in front of each transformer which admits of the unit being run out of the transformer house (on a track) after which it is run down to the power house for disassembling. This greatly reduces the size of the transformer house and saves the expense of extra equipment. Another feature is the provision made for a railway crossing over the main river dam which it is intended the Peterborough Radial Railway will use at some future date. In the power house perhaps the most noticeable variation from every day practice is the heavy fly-wheel attached to the generator and particularly the thin disc shape of this wheel by which the manufacturers were able to greatly increase the inertia of their generator without practically any change in design other than a slight widening of the base frame work.

Self-Starting Motors

The electric motor has proved so satisfactory for driving mine pumps and fans that it seems almost impossible to improve it. It can be placed wherever a pump or a fan can be located, a couple of wires supply it with the power it needs, and when running it requires no attention whatever beyond occasional inspection and oiling. In fact, these motors have proved themselves so useful and economical that they are rapidly displacing all other forms of power for fan and pump service wherever electricity is available.

An improvement has, however, been recently developed which greatly increases the value of motors for mine work. This improvement consists in making the direct current motor self-starting. Heretofore, while it has been possible under some conditions to start them from the power house, most motors driving mine pumps and fans had to be started by hand. Hence, if the power went off temporarily for any reason, the motors stopped, necessitating an attendant going to each station to start them again. With the new self-starting d.c. motors, this inconvenience is done away with. When the power fails, the motors stop, it is true, but as soon as the power comes on again, the motors start automatically and settle down to work as though nothing had happened. Moreover, starting boxes are rendered unnecessary, and the wiring is of the simplest possible character. An occasional visit of inspection is now all the motors require. Otherwise they can be left entirely to themselves.

These motors have been thoroughly tried out in practical service and their uses are commending them highly. The electrical characteristics of the self-starting motor differ but little from those of the usual type, the only alteration being in the use of a heavier compounding winding which reduces the flow of current when starting. Mechanically, there is no change. Self-starting motors are made in ratings up to 20 horse power for the voltages usually employed in mine work. They can be supplied for all kinds of pump and fan service.

Red vs. White Cedar

At a recent convention of the Western Red Cedar Association held in Spokane, a preliminary report was made by the United States Department of Agriculture on the relative strength of the northern white cedar and the western red cedar. The report covered a series of tests on fifteen 7 in. top 25 foot poles of each species. The northern white cedar poles were purchased from the Minnesota district which produces them. The western poles were shipped from one of the yards in the neighborhood of Sandpoint, Idaho. In each case, care was taken to secure poles representing the average grade of material.

The test goes to show that the western red cedar pole exceeds in strength that of the Michigan white cedar type by approximately 100 per cent., and is as follows:—

"Since all tests on full sized poles of Michigan white cedar and Idaho red cedar furnished by your association have been completed, I wish to give you a preliminary report of the results of these tests.

"In all, fifteen poles of each species were tested in an Olsen 200,000 pound Universal Testing Machine which had been modified with special framing to accommodate the full sized poles. The two ends of each pole were held stationary and the load was applied at a point corresponding to the ground line after the pole is set.

"The Michigan white cedar poles were much inferior in quality to the Idaho red cedar poles, since all of the Michigan poles contained varying amounts of center rot and were very rugged due to a large number of knots, some of them of considerable size. Only three of the Idaho cedar poles showed traces of center rot and all Idaho poles were quite free from knots. The center rot and knots in poles are serious defects when the strength is considered.

"The following figures show a comparison between the strength of the two species of poles which your association contributed:—

	Modulus of rupture, lbs. per sq. in.	Breaking load lbs. per sq. in.
Michigan white cedar	3,400	8,430
Idaho red cedar	6,670	18,510

"The breaking load given above is not the actual average load required to work the poles to destruction, but is the actual load modified so as to compare the poles on a basis of equal diameters. The modulus of rupture is the unit load in pounds per square inch which disregards size and length."

Farewell to Mr. Kelly

Hamilton, the Birmingham of Canada, the city with 400 industries and which claims the proud distinction of utilizing more electric energy for motive power purposes in proportion to its size than any other city in Canada, was the scene of an enthusiastic meeting of the employees of the Hamilton Electric & Power Company, held under the auspices of the Hamilton section of the N.E.L.A. on Wednesday, January 22nd, over 100 employees being present. Much added interest surrounded this meeting as it was understood to represent the farewell of President T. F. Kelly, one of the best known men to-day in the electric light field in the United States and Canada.

The program included a farewell address by president Kelly; several musical selections; an illustrated lecture on the Panama Canal by G. W. Magalhaes, T.E.L. Co., Toronto; presentation of life-size photograph of President Kelly to the section; response by president-elect L. W. Pratt; and the presentation of a cabinet of silver to Mr. Kelly by the employees of the company. During the evening short addresses were also given by treasurer G. D. Fearman, Mr. W. G. Angus, general superintendent light and power; line superintendent Chas. G. Choate, and by Mr. Geo. W. Ames, ex-president of the Buffalo section.

Mr. T. F. Kelly

The meeting assumed largely the nature of a farewell to its president, Mr. Thos. F. Kelly, who has been contract agent for the company for the past four years, during which time he has filled the position with credit to himself and to the satisfaction and benefit of the company. Mr. Kelly is regarded as a specialist in sales of the commercial end of the electric light and power business, and has been employed with the H. E. L. & P. Co. in various capacities, continuously, since the year 1900. He is leaving very shortly to assume the position of sales manager at the Dayton Electric Power & Light Co. and its subsidiaries, where he will have a much larger field for the expansion of his activities. To the efforts of Mr. Kelly, almost entirely, is due the formation of the Hamilton section of the N.E.L.A., and since its inception he has held the office of president. He is also a member of the Commercial Committee of the Canadian Electrical Association.

Aside from his work in the electrical field, Mr. Kelly has taken an active interest in the development of Hamilton. He was secretary of the Hamilton Ad Club, was an aggressive member of the Board of Trade, and was also on the Publicity Committee of the Hamilton Centennial Association. His affable manner and personality, together with his sterling qualities, have made him a host of friends in Hamilton, who will regret very much that he is leaving them, but will load him with good wishes for continued advancement in his new sphere of action.

The New York state government is at present fighting to wrest from the federal government the control of the water powers on the Niagara river.

Re Underwriters' Requirements

The Editor of the Electrical News,
Toronto, Ontario.

Dear Sir,—I note with great interest your editorial and the accompanying re-print of report made to the British Board of Trade on the above matter. While you are in the main correct as to the high standard of British manufactured articles, there are still a number of appliances and articles of manufacture of British make that are not in many respects up to the standard of American or Canadian goods intended for similar purposes. I know of what I speak as I have been in this work for the last eighteen years and have repeatedly had to refuse to accept British made appliances and material, although this city does not, in spite of the statement of Mr. Wickes, insist upon the Laboratories label. It seems to me in this question that two points have to be considered, namely; first, the standard of quality and the fitness for the duty and, second, the standardization of dimensions of certain appliances, such for instance as cutouts or fuses. You will remember the years of effort that were necessary before a simple matter like the standardization of enclosed fuses was reached and similar action in regard to lamp sockets and lamp bases.

Mr. Wickes seems to be afraid that under the present arrangements the Laboratories impose no restrictions as to the "danger to life" factor. It is true that the Underwriters are largely represented on the National Code Committee, but all the other interests are also represented, and during the last few years the question of "danger to life" has been increasingly emphasized in the Committees' rulings and there are numerous rulings in the code that not only protect against fire, but also enforce the necessary safeguards for the protection of life, as for instance, the grounding of the neutrals of the low tension system. It is rather remarkable that Mr. Wickes should lay stress on this point, as in his own country the requirements have been extremely lax on this point up to a very recent date, in fact, until recently apparatus and appliances have been sold and used in Great Britain that would not be allowed in this country where a properly organized Inspection Department existed; for instance, a long skirted Edison base lamp having a live projection of one and a half inches below socket. Such crude and unsafe methods were eliminated years ago on this side of the water and inspection departments of this country find this form of lamp to-day (constantly imported from European points) to be one of the most serious menaces they have to deal with.

While the British manufacturers are no doubt handicapped by the present conditions, and while as an Englishman myself I am doing everything I can to facilitate the placing of their goods on this market, the whole trouble is due to the fact, to use the words of your editorial, "The Englishman does not feel the need of the same progressive step until he comes into direct contact with the United States product in this continent," and judging by the increasing number of fatalities in the British Isles, due to electrical causes, it will not be long before public opinion will force the authorities to take a progressive step and call for the standardization of electrical fittings generally.

I believe that we should in Canada have a laboratory for testing purposes either under the Government or Underwriters' auspices, whose rulings would be accepted by the American Laboratory, we in turn accepting theirs, so that a uniformity of ruling would exist. I understand that there have already been some proposals along this line, and with the institution of such an examining body the British manufacturers would not be under any disadvantage in exporting goods to Canada. I have at times come in contact with some of the leading members of British firms, who have been over here looking up trade possibilities, and in most cases they have expressed their readiness to adapt their goods to Canadian practice; on the other hand, there are Britishers of the well-known stubborn variety who will think that "what is good enough for John Bull is good enough for Johnny Canuck," but the latter has a habit of suiting himself. I imagine that a form of British standard that would be recognized the world over, will hardly come about.

I cannot refrain from expressing my indebtedness to the American Laboratories for the excellent work they are doing. It is of the very greatest value to the department over which I preside, in fact I do not know how we could get along without the valuable assistance they render from time to time. We are especially pleased with the way they are handling the rubber covered wire situation to-day. Canadian manufacturers have found no difficulty in complying with the Laboratories' tests. Canadian manufacturers are to-day turning out wire with the Laboratories labels and I was only the other day requested to collect samples of wire found in the field and forward same to Chicago, when they would be tested and reported upon free of charge. The value of this service is, as I have said, very great, and I do not think it is sufficiently appreciated.

Trusting that your article will promote a healthy discussion on this important matter, I am

Yours truly,
F. A. Cambridge, City Electrician.
Winnipeg, Man., Feb. 5, 1913.

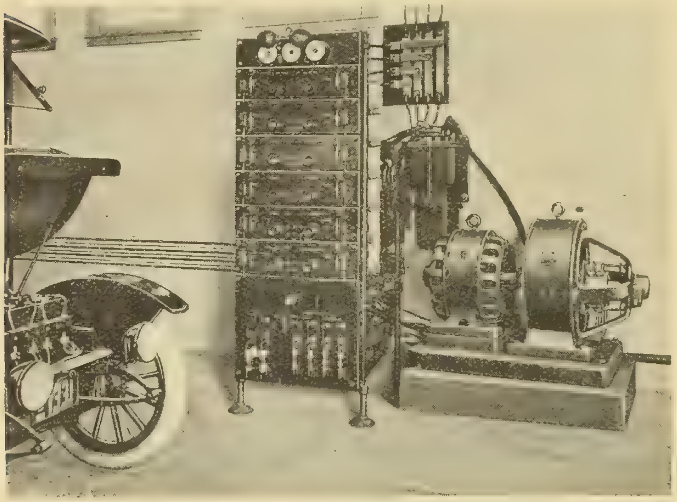
A Pioneer Gone

The announcement of the recent death of Mr. Jno. Patterson, of Hamilton, Ont., carries us back some fifteen years to that epoch-marking day when the Cataract Power Company of Hamilton had just completed its generating station at DeCew Falls and its 35 mile, 22,500 volt transmission line to Hamilton. This line, the longest, and carrying the highest voltage in Canada, at that time, was the conception of Mr. Jno. Patterson. In this connection the following quotation from a description of this plant taken from the Electrical News of December, 1898, will be of interest. "Over three years ago, when the transmission of energy by electricity over long distances for commercial purposes was still in an experimental stage, the possibility of utilizing this magnificent fall of over 200 feet at DeCew Falls, where the waters of the Beaver Dam creek tumble over the Niagara escarpment, for the generation of electrical energy to be transmitted to the city of Hamilton, 35 miles distant, first suggested itself to Mr. Jno. Patterson, of that city. After numerous surveys and examinations into the physical possibilities of the scheme, Mr. Patterson associated with himself the Hon. J. M. Gibson, Jno. Moodie, Sr., Jas. Dickson and J. W. Sutherland, procured a charter and formed the Cataract Power Company of Hamilton, Limited, for the purpose of the development of this power and its transmission to Hamilton." In recent years Mr. Patterson has shown his continued faith in electrical matters in numerous attempts to finance suburban railways in and around his native city. That he was somewhat unsuccessful in realizing his hopes was due to the adverse conditions under which he worked, however, and not in any sense to any lack of faith in the unbounded possibilities of suburban electric traction as a solution of many of the present-day commercial problems.

The House Foreign Affairs Committee of the United States government recently made a report on the bill for a general regulation of the use of the water of Niagara Falls for power purposes. It is understood that no change will be made in the existing law limiting the amount of water to be diverted on the United States side to 15,600 cubic feet per second.

Electric Vehicle Battery Charging

The accompanying illustration shows a new line of battery charging equipments which has been placed on the market by the Westinghouse Electric & Manufacturing Company. A special feature of this outfit is the mounting of all control apparatus on one board. It is usual present practice to have each charging rheostat a separate unit which is located near the vehicle being charged; the charge is regulated by reading the vehicle meters. Considerable difficulty has been experienced in charging by this method because the operator cannot see the vehicle meters when operating the rheostat, and moreover the vehicle meters are apt to be inaccurate on account of vibration and rough usage—in some cases the pointers are broken off. These difficulties are overcome in this new line. The operator makes the proper connections, regulates the rheostat, and reads the charging rate from accurately calibrated meters while standing at the board. The outfit is, moreover, very compact and takes up minimum floor space, as indicated by the illustration which shows a complete installation for charging twelve vehicles at the same time. This switchboard takes up a floor space of 30 ins. by 36 ins.



Battery charging outfit—All control from one point

The switchboard is unique in being made up of horizontal sections. The top section carries the meters which give readings of current and voltage of both the incoming direct current supply and of each battery being charged.

Below the meter sections are the charging sections. Any desired number of such sections can be installed, from one to as many as the limitations of height will permit. The illustration shows six. Additional sections can be supplied at any time. If more sections are required than will conveniently go on one board, they can be mounted on extra panels, which can be brought up to the height of the first one by the use of blank sections if desired. Each charging section furnished a complete equipment for charging two separated batteries. The rheostat can be mounted on the back of the panel, as shown in the illustration, or can be separately mounted wherever desired. Rheostat can be furnished for any type of lead and Edison batteries, and for any number of cells. As each rheostat is independent, the switchboard can be made up to charge any desired variety of cars.

In charging a battery from this board, all that is necessary is to insert the charging plug, close the charging circuit, and adjust the rheostat. Each charging circuit is identified by a name plate. The volt meters are connected in the circuits by means of plugs. The individual charging circuit can be controlled by either switches or circuit breakers. If circuit breakers are used, they can be equipped with relays which protect the batteries from overloads and the circuit from reverse current.

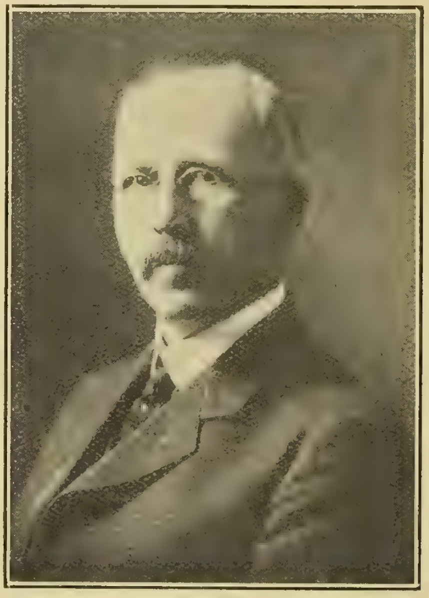
The bottom section carries apparatus to control the incoming direct current power, and also, if necessary, the motor-generator set. If the motor-generator set is operated from alternating current, the auto-starter for the motor is mounted on the wall as shown in the illustration. If a field rheostat is used to adjust the generator voltage, it is also mounted on the bottom section.

Motor-generator sets of any capacity and for operation on any commercial circuit can be furnished. It is usual practice to furnish a direct-current generator the voltage of which can be adjusted from 60 to 125 volts by field control. This adjustment permits the voltage of the charging current to be made slightly higher than that required for the batteries being charged, so that there is no great loss of power caused by inserting a large amount of resistance in series with the battery.

In cases where a large motor-generator set, 50 kw. or larger, is required, the addition of another set of approximately 7½ kw. is recommended. The smaller set will efficiently take care of hurry-up calls for charging one or two vehicles when the larger set is shut down, and can be run in parallel with the large set to help out during heavy or peak-load conditions.

Electrical Prosperity in Ottawa

Some concrete evidence of the prosperity of the Ottawa Electric Ry. Co. and also of the growth of the city of Ottawa was given at the annual meeting of the company, held in the head offices on Albert street, on Monday, February 3rd. Nearly 3,000,000 more passengers were carried on the cars during 1912 than in 1911, the gross earnings were nearly $95,000 greater than in the previous year and the increase in net amounted to over $45,000. The total dividend for the year paid to the shareholders was 15 per cent., the same as in 1911. The shareholders passed an unanimous vote of thanks to Mr. Thomas Ahearn, the president, and to the board of directors, for conducting the business of the year so successfully. Mr. Ahearn stated that it was expected



Mr. J. D. Fraser

the receipts of the company for 1913 would reach the million dollar mark.

One important change was made in the personnel of the board of directors in the election of Mr. James D. Fraser, secretary-treasurer of the company, to succeed Senator Cox, resigned. Mr. Fraser has been connected with street railway work in Ottawa for the past thirty years. He was general manager with the old Ottawa City Passenger Railway Company and when the Ottawa Electric Railway Company took over the system in 1891 was appointed secretary-treasurer, a position he has capably filled ever since. The full board of directors are: President, Thomas Ahearn; vice-president, Warren Y. Soper; Thomas Workman, Elbert N. Soper, George P. Brophy, T. Frank Ahearn, and James D. Fraser (secretary-treasurer).

Municipality Makes Profit

The recent annual report of Mayor Ellis, M.L.A., Secretary of the Municipal Electric Commission, Ottawa, showed a net profit for the year of $35,069.02. During the year the number of customers has been increased from 5,337 to 6,284, and the number of incandescent lamps installed from 93,190 to 109,565. When the city took over the plant in 1905 there were 1,314 customers, 26,160 incandescent lamps, 175 arc lights and 64 motors. The close of 1912 finds the city with 914 arc lights and 231 motors.

The percentage of maintenance and operation, exclusive of power, was 36 1/3 per cent. for the past year. In the seven years and a half the city has been operating the plant less than two per cent. of the total amount of the accounts has been lost. Mayor Ellis announced it to be the intention of the Commission to use the surplus of $35,000 for the extension of the plant, and also in a reduction in the rates.

Adding to Pumping Equipment

Three 50 h.p. induction motors have just been installed by the Ottawa municipal electric department at the pumping station on Lemieux Island. The motors, which were supplied by the Canadian General Electric Company, are now driving three Rees Roturbo pumps of 12,000,000 gallons capacity, which were supplied by the Manisdee Iron Works of Manisdee, Mich., the United States agents for the Rees Roturbo plant, of Wolverhampton, England. The pumps are for the purpose of driving the city's water supply through the pipes instead of drawing it through, as was done formerly. It has been alleged that the drawing of the water through the intake pipe had a good deal to do with causing the recent typhoid epidemic in Ottawa, by sucking contaminated water from Nepean Bay. Since the new pumps began to work the water is taken from the river at the mouth of the intake pipe and lifted into a well 12 feet above the river level and then forced through the intake pipe to the city pumping station.

Will Double Capital

Application has been made by the Ottawa Electric Company to the Private Bills Committee of the House of Commons for authority to increase the capital of the company from $1,500,000 to $3,000,000. The Ottawa Gas Company also made application at the same time for authority to increase their capital from $500,000 to $2,000,000. Both applications were granted. Mr. George F. Henderson, K.C., acting for the companies, said that increased capital of the former company is required to keep pace with the demand for installations. The need of an additional plant and to provide for the large demands being made for gas was the reason the latter company needed extra money.

Advise us of any delay in delivery.

Activities Around Montreal

Owing to the generosity of Mr. J. E. Aldred, president of the Shawinigan Water & Power Company, the town of Shawinigan Falls, P.Q., now possesses a technical school, built at a cost of $50,000. The structure is of brick, and is equipped with electrical and other technical apparatus, and here employees of the company and any others who desire will receive theoretical as well as practical instruction in electrical and other work, both French and English classes being formed. No other place in the province, except Montreal and Quebec. has such an institution, although there has been a technical school in Shawinigan Falls for two years, which was held in rented rooms. At the formal opening of the school, Mr. Aldred, in handing over the deeds to the governors, promised that if the time should come when a building four times the size of the one he had given was needed, it would be forthcoming. He had seen the growth of Shawinigan Falls for the past twelve years, when he had organized the power company, and now that prosperity had come as a result of the vast resources of the district, he wanted the youth of the place to have such educational advantages as would help them later to further scientifically develop the district, and make it the leading manufacturing district in the province. This, said he, would ultimately come, but education was needed.

A special train conveyed a large number of visitors to the town, these including Mr. T. McDougall, vice-president of the company (who presided at the meeting), Mr. Julian C. Smith, chief engineer, Mr. H. Murray, treasurer, and other officials; several prominent educationalists, and members of the Provincial Cabinet. During the afternoon the party visited the power plant.

Outremont will Generate Power

The Town Council of Outremont, P.Q., intend to generate their own power for electric lighting purposes. This announcement was made at a conference between the Council and Mr. R. F. Jones, manager, and Mr. W. H. Winter, engineer, of the Bell Telephone Company, in reference to a scheme of the company for laying underground conduits at a cost of $70,000. The Council have also a conduit scheme, prepared by Prof. L. A. Herdt, and both plans being on similar lines, it was suggested that the council should co-operate with the company in building one system only, with separate trenches for lighting and telephone wires, or alternately, that the council should construct the conduits and charge a rental to the telephone company. The latter, however, prefer to build their own conduits, and it was agreed that it was imperative for the council and the company to build the conduits simultaneously in order to avoid unnecessary tearing up of the streets. The adjustment of this matter, and also the question of erecting poles in lanes to carry lighting and telephone wires, was referred to the electric lighting committee.

May Reduce Number of Stops

At a conference between an aldermanic committee, Mr. Hutchison, manager of the Montreal Tramways Company, and Mr. L. Stern, electrical engineer, the question of the elimination of stops was discussed. Mr. Alderman Lapointe, the leader of the Council, intimated that the city should ask the Legislature at the next session for authority to construct an underground municipal tramway, running north and south, and east and west, and when it was built to lease it to the present company for operation. Mr. Hutchison argued in favour of fewer stops and the construction of parallel lines, and he submitted a memorandum showing the relief that might be expected to result from the elimination of stops.

Reported to C.S.C.E.

At the recent annual meeting of the Canadian Society of Civil Engineers, held in Montreal, the Canadian Committee of the International Electrotechnical Commission, of which Prof. L. A. Herdt is chairman, reported that during the year 1912 six publications were issued by the Commission, the most important of which related to Standard Symbols and the rating of electrical machinery. The next meeting of the complete Commission is to be held in Berlin, Germany, in September, 1913, at which time the various propositions now under consideration will be finally adopted. An International Congress, a meeting that will be of the greatest interest and importance, is planned for 1915, in conjunction with the Panama-Pacific Exposition to be held that year in San Francisco, Cal.

Substitute Electric for Steam

In a report to the Montreal Board of Control, Mr. Champagne, boiler inspector, suggests that the city might take steps to secure the abolition of steam locomotives entering the city and the substitution of electric engines. His plan is for all trains destined for local stations on the Island of Montreal to be hauled by electric power or gasoline, this including shunting engines. The expansion of Montreal, he says, is bringing the matter to a point where it will have to be met. The smoke nuisance and the danger from locomotive sparks in the residential districts are reasons advanced in the recommendation as being sufficient for the adoption of electric engines. Controller Godfrey points out that this is entirely a matter for the Railway Commission, and not for the city.

The Perkins Electric Company

The Perkins Electric Company, Limited, have been incorporated with a capital of $50,000, and offices have been taken at 322 Craig street west, Montreal. Mr. George F. Perkins is the president and managing director, Mr. F. J. Parsons, vice-president, and Mr. P. F. Fergusson, secretary-treasurer. The business is that of wholesale dealers in and importers of electrical equipment, and the sole Canadian agency has been secured for Bee Dee fixtures and fixture parts, finished and unfinished, manufactured by the V. Brandt Dent Company of Watertown, Wis. The Perkins Company are also the Canadian agents of the Crown Novelty Company, Chicago, makers of electric portable lamps. Other lines carried include carbon and tungsten lamps, flaming arc lamps, sign lamps, switch plates, and flexible conduits.

May Follow Ontario's Lead

In the annual report of the Council of the Montreal Board of Trade reference is made to the Ontario Hydro-electric Commission, which is undertaking the development of water powers in a very comprehensive manner throughout that province and expects in the course of a few years to offer power at a rate which will be very advantageous both to Eastern and Western Ontario manufacturers. Should this movement, it is stated, prove successful and result in placing Ontario industries in a position of greater advantage to compete with those of Montreal, it would demand consideration by the Board of Trade and other Montreal trade organizations.

A Start at Carillon Falls

The National Hydro-electric Company, which propose to develop a big water power at Carillon Falls, and who are now working on a small plant of 1,000 horse power, in four units, have applied to the Montreal City Council for permission to enter the city and sell power. The application has been referred to the legal department and Mr. Parent, superintendent of the lighting department, to look into the question of the contracts now in force. The company have the right of appeal to the Quebec Public Utility Commissioners in the event of any municipality refusing permission. The financing of the company is now engaging the attention of the directors.

Iroquois Falls

The Abitibi Pulp & Paper Mills, Limited, which is building a big paper mill at Iroquois Falls, on the Abitibi River, Ont., have obtained a lease of the water powers of Iroquois and Couchiching Falls, and have the right to hold and control the waters of Abitibi Lakes for power purposes. Mr. Henry Holgate, of Montreal, has reported on the water powers, and estimates the total power available on the company's property to be 57,195 shaft h.p. Mr. Holgate says that the three water powers are all close together, that the large storage of water in Lake Abitibi is a great advantage, and there need be no fear of shortage of water at any time of the year.

50,000 H.P. at Grand'Mere

The Laurentide Company, Limited, have under way the construction of a large hydro-electric system at Grand'Mere, Que. It is said that at this point 50,000 h.p. can be developed which will bring the total of this company's power up to 70,000 or 75,000 h.p. A contract has recently been awarded to the H. E. Talbott Company for the construction of a 1500 foot dam at a cost estimated at about $1,500,000. Much of this power will undoubtedly be used direct from the turbine shaft, but it is said that any surplus which can be transformed to electric power has already been contracted for.

Megantic to Develop Power

The Quebec Government has transferred to the town of Megantic certain water powers on the River Chaudiere, which, when developed, are estimated to give two thousand horse power. It is the intention of the town to prosecute its claim to further water powers on the Chaudiere, which will give, it is expected, at least an additional 2,000 horse power. These water powers are within seven miles of the centre of the town, and extend to the limits of the township of Gayhurst.

Exhibit of G. V. Electrics

Among the exhibits at the last automobile and truck show held in Montreal was an electric vehicle made by the General Vehicle Company, of Long Island City, N.Y. This company was represented by R. E. T. Pringle, the exhibit being in charge of Mr. J. D. Lachapelle and Mr. J. W. Mochon. A number of "G. V's" are in use in Montreal and Toronto, the Canadian Express Company having five, the Montreal Light, Heat & Power Company one, the Canadian Consolidated Rubber Company one, and Eugene Phillips Electrical Works, Limited, one.

Notice of incorporation of the Dominion Traction & Lighting Company, is given with a capital of $12,500,000. This company is empowered to carry on the business of producing and supplying gas and electricity for light, heat and power. Its privileges include the right to hold securities of other companies.

The mid-winter convention of the American Institute of Electrical Engineers will be held in the Engineering Societies' building, New York, February 26th-28th, 1913.

Regina's Municipal Railway

The Regina Municipal Railway System operated as a public utility now comprises approximately 14½ miles of single track, of which about 6¼ miles are paved, the remainder being ballasted. A considerable amount of the system is composed of double track with steel pole and steel bracket construction. The greater part of this mileage was installed during the year 1911, and a special portion from the post office was rushed to completion so as to give a service to the exhibition grounds during the Dominion exhibition held in Regina the latter part of 1911. During the year 1912 about four miles of single track was added to the system.

Up to the present time the passenger rolling stock has consisted of two double truck cars and ten single truck cars, all of which are kept in operation practically all the time. The cars are operated on four separate routes giving a ten to fifteen minute schedule. The two double truck cars and four of the single truck cars were supplied by the Brush Electrical Company, of Loughborough, Eng., and were the first purchased by the city. The other six single truck cars were later obtained from the Preston Car & Coach Company. These latter are equipped with Westinghouse 101-B motors and Curtiss single trucks.

The rolling stock during the latter part of 1912, however, was found to be totally inadequate, so that the city has had on order for some time eight double-truck cars, some of which have arrived, and all of which it is expected will be operating during February. These cars are being supplied by the Preston Car & Coach Company, and will bring the total of rolling stock to twenty units. These latter cars are being built according to the following specifications: length of car body, 28 ft.; length of front vestibule, 5 ft.; length of rear vestibule 7 ft.; length of car over-all 41 ft.; style p.a.y.e.; single end control; Canadian Westinghouse 101-B motors and air brake equipment, and Canadian General Electric G.E. 80 motors and Brill 27 G.I. double trucks, 4 ft. 6 in. wheel base, standard gauge.

In addition to the above, eight double truck cars and six single truck cars have recently been ordered from the Preston Car & Coach Company. These will have Canadian Westinghouse and Canadian General Electric equipments with Brill 27 G.I. double and 21 E single trucks, for delivery in the early spring.

Fig. 1. Regina municipal railway employees

The balance sheet for the year 1912 of the Regina municipal railway system contains some interesting figures. As stated above, the road commenced [illegible] 1911 and the revenue for the last five months of 1911 was $22,973. As showing the great advance made with one year's operations, the report states that the revenue for the corresponding five months of 1912 was $53,121, which is an increase of $30,147, nearly 150 per cent. The rate of progress can be shown in another way by the relative number of passengers carried. During the five months ending December 31, 1911, 467,908 passengers were moved. In spite of the fact that this included operations during the Dominion Exhibition held in Regina in August of that year, this number has been almost trebled with one year's operation, for during the five months ending December 31, 1912, the number of passengers carried was 1,188,748.

Fig. 2. Carbarns, with office staff and car-house employees

The balance sheet for 1912 shows that after payment of all operating expenses, including fixed charges on interest and sinking fund accounts, there remains a net revenue of about $4,000, which is a very satisfactory and gratifying result. The estimated population of Regina is now in the neighborhood of 40,000. The system is at the present time carrying some 11,000 people per day, which, with ten cars in operation, is at the rate of 1,100 people per car per day.

The ticket schedule for Regina follows: regular tickets, 6 for 25c; labor tickets, good 6 to 8 a.m. and 5 to 7 p.m., 8 for 25c; school tickets, good any time, 10 for 25c; regular tickets, in book form, 25 for $1; city employees tickets, 50 for $1.50; regular cash fare, 5c; hours of operation, 6 a.m. to 12 p.m.

The 1913 programme calls for construction of an additional twenty-one miles of single track at an estimated cost of $650,000, with rolling stock to cost some $175,000. Tenders have just been called for on the material required, and as soon as the frost is out of the ground, a commencement will be made. It is expected that by an early start the whole of the proposed programme can be carried out during the early summer, and before shortage of labor is experienced owing to the demand for laborers in the harvest fields.

Of the photographs shown herewith, Fig. 1 represents practically the entire force engaged up to the present on this system. Fig. 2 shows a general view of the car barns with the office staff and the car house employees. Fig. 3 shows the car barns from the south with snow sweeper and Peteler dump cars used for freighting purposes; the snow sweeper is the Preston type. Fig. 4 shows the interior of the machine shop with foreman and car house employees. The total length of the car barns is 275 ft. The offices and store room are 75 ft. x 20 ft., comprising a superintendent's office 9 ft. x 20 ft., a general office 25 ft. x 20 ft., an employees' room 20 ft. x 20 ft., and [illegible]

The machine shop is 75 ft. x 40 ft. with pit track in which there is installed the following equipment—one planer, one 18-in. swing double-back geared lathe, one 1½-in. bolt cutter, one pedestal emery grinder, one power hack-saw machine, one Barnes 18-in. power drill and one 10-in. hand drill The machine shop is complete with overhead traveller, Vale & Townes block and chain, blacksmith's hearth. and all facilities for repair and maintenance work.

The car body repair shop is 50 ft. x 40 ft., containing buzzer, planer and rip-saw with pit under track. There are two fireproof oil houses, one 10 ft. x 10 ft. and the other 5 ft. x 5 ft. Another shop 25 ft. x 40 ft. contains an 18-ft. bed, 48-in. swing, McCabe two-in-one lathe, and one 150-ton wheel press. The paint shop is 50. ft. x 40 ft.

The outside buildings consist of stables, sand-drying house and a recreation and instruction room for employees, this latter being 75 ft. x 30 ft. The recreation room is for the exclusive use of employees and contains all types of parts used in the construction of passenger cars. There is also reading matter dealing with construction and operation data, useful to the employee, no matter in what part of the system he may be engaged.

Power for the system is supplied by the city electrical department, the street railway paying at the rate of 2c per kw. hour for such power as is metered to them at the power house. The equipment up to the present time consists of a 400 kw. d.c. Siemen's generator with Belliss & Morcom engine. Steam is generated at 150 lbs. pressure. The line voltage is 600. This machine has been in constant use since the 28th day of July, 1911, working on an average 19 hours per day, during which time shut downs due to fault of this equipment have been less than six hours. At the present time this unit is being duplicated, the new unit to be kept for emergency purposes.

The Regina municipal railway system owes practically all its successful operation to-day to Superintendent Doughty, who has been in the employ of the city in that capacity since the 7th of April, 1911, with the exception of a few months during 1912, when he assumed the responsibility of the construction of the track-work for the Lethbridge municipality. This required less than five months, and Mr. Doughty returned on August 24th of last year to take up his work as superintendent at Regina again. Since that date something over four miles of track have been built and the entire system has been re-organized.

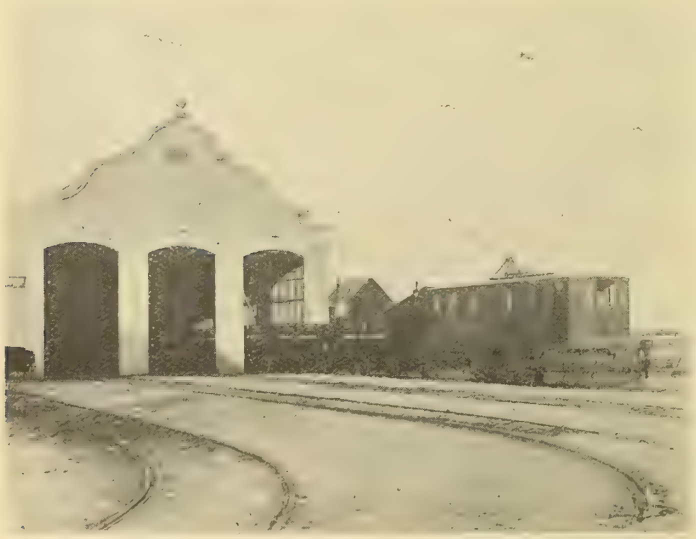


Fig. 3. Carbarns, snow-sweeper and dump cars

The personnel of the Regina system is as follows: city electrician and power house superintendent, E. W. Bull; superintendent of railway system, H. Doughty; general foreman, H. Baxter; chief inspector, S. E. Patterson; accountant, R. Young; chief clerk, G. Milnes; constructing engineer, T. Brockman. The system is controlled by a commission consisting of Messrs. G. A. Mantle and L. A. Thornton.

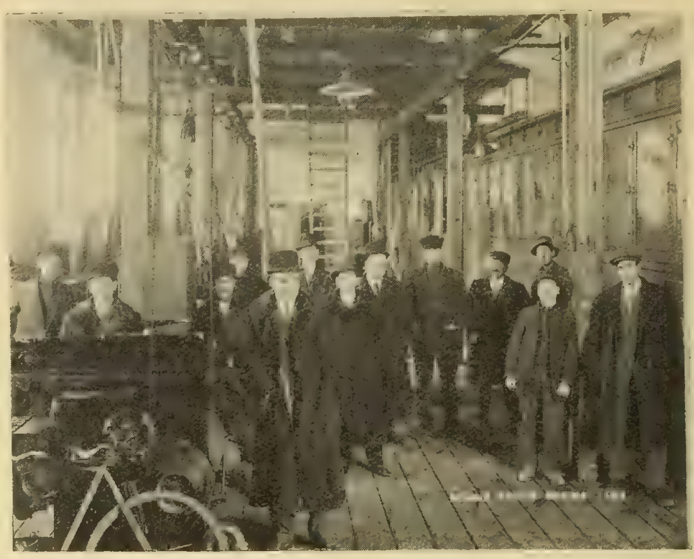


Fig. 4. Interior machine shop—Regina municipal railway

Toronto Rejuvenation

Toronto Jovians started the month of February in real Jovian fashion, by holding perhaps their most successful rejuvenation, on Saturday evening, February 1st, in the ball room at McConkey's. All the stage settings used at the rejuvenation last fall were again brought into service, and included several very effective scenes, such as,—Jupiter's castle in the clouds, Neptune in the depths of the briny deep, Pluto in Hades, and Vulcan at his forge. A new electrical effect was introduced in the way of a crown, which was worn by Jupiter; it consisted of nine miniature flame lamps, reproducing their new emblem, the Head of Jove. All the scenic electrical effects were designed and supervised by Edwin B. Pike, Alternate Statesman. Toronto Jovians can pride themselves on the fact that no officer on the degree team carried a ritual on the stage. Morgan P. Ellis, Statesman at large, had entire charge of the degree team and floor work.

A great deal of the success of the rejuvenation was due to the manner in which all the Jovians co-operated; this was proven by the forty-two candidates, which S. C. DeWitt, chairman of the membership committee, had on hand to travel the road to Jovianism. After the initiation ceremonies an elaborate Dutch lunch was served, at which Parker H. Kemble presided.

Twin Cities get C. E. A. Convention

The Canadian Electrical Association will hold its next annual convention at the twin cities of Port Arthur and Fort William, June 23, 24 and 25. This was decided at a meeting of the managing committee held in Toronto, Friday, January 31. Very favorable transportation arrangements have been made, and a big convention is anticipated. Mr. W. L. Bird, of Fort William, general superintendent and secretary of the Kaministiqua Power Company, is president of the association.

The Montreal office of the International Engineering Works, Limited, has been changed to No. 1001 Transportation Building.

Personal Announcements

Mr. W. E. Skead has been appointed city electrician of the city of Brandon, Man.

Mr. Geo. Ostrander has been appointed superintendent of power and light in Brampton.

Mr. A. A. McQueen has been appointed assistant power engineer of the Winnipeg municipal system.

Mr. T. H. Hogg, managing editor The Canadian Engineer, has resigned to associate himself with the Hydro-electric Power Commission of Ontario.

Mr. F. A. Creighton, for several years city engineer of Prince Albert has been appointed manager of the civic hydro-electric development work at LaColle Falls, some 15 miles out from Prince Albert.

Mr. James Bennett, chief electrical inspector of the Canadian Fire Underwriters' Association, Montreal, was elected president of the Western Association of Electrical Inspectors at their convention, held at St. Louis, Mo.

Mr. Arthur H. Hull for the past three and a-half years associated with the engineering department of Smith, Kerry & Chase, has recently joined the designing engineering staff of the Hydro-electric Power Commission of Ontario.

Mr. A. Hector Dion, superintendent, the Moose Jaw Electric Railway Company, was married on January 16th to Miss Livingstone, of Listowel. Mr. and Mrs. Dion are spending their honeymoon in Europe and will return to Moose Jaw in March.

Mr. E. J. Philip, for many years in charge of electric light and power in Berlin, Ont., first with the private company and later with the municipality, has resigned to accept the position of manager of the light and power department in Brockville.

Mr. John Murphy, electrical engineer to the Board of Railway Commissioners, addressed the Toronto section of the American Institute of Electrical Engineers on Friday evening, February 7th, on the topic "A Holiday Trip to the Panama Canal Zone."

Mr. G. W. Millichamp, secretary the Chamberlain and Hookham Meter Company, underwent an operation for appendicitis some five weeks ago. For some days Mr. Millichamp's condition was most critical, but we are pleased to learn that during the last few days reports are much more favorable. We wish him a speedy return to his usual robust health.

Mr. P. H. Kemble, for the past year general sales manager of the Toronto Electric Light Company, is resigning to accept the position as manager of the commercial department of the Union Gas & Electric Company, of Cincinnati, Ohio, resignation to take effect February 18th. Mr. Kemble will be greatly missed in and around Toronto, for, during his brief sojourn in Canada he has been particularly active in promoting the interests of the electrical business. In the Canadian Electrical Association, the Toronto section of the A. I. E. E., the Sons of Jove and in his company's own section of the N. E. L. A., he has been uniformly interested and helpful and will leave many friends who wish him continued success in his larger sphere of activity.

Mr. R. J. Hiller, Montreal, has severed his connection with the Canadian General Electric Company, having accepted the position of sales manager of the Engineering Equipment & Supply Company, St. James street, Montreal. Mr. Hiller is well known throughout the Canadian electrical trade, having been identified with the industry since 1886, when he entered the employ of the Royal Electrical Company, of Montreal.

Canadian Telephone Progress

The "Compagnie Rurale de Telephone Soulanges" has been organized to operate a line of rural telephones in the highways and roads of the county of Soulanges and part of the county of Vaudreuil.

After studying the telephone systems of America and Europe, the chief electrician of the Post and Telegraph Department of New Zealand has recommended that a full automatic telephone system be installed in Auckland, Wellington, Christchurch and Dunedin.

The village of Blythe has applied to the Ontario Railway and Municipal Board for an order rescinding an agreement between the Bell Telephone Company and the rural telephone system of the township of McKillop. Under the present arrangement for inter-switching connections a double tariff is charged.

The Independent Telephone Company recently held its annual meeting at Vineland, Lincoln county, when the annual report showed that the profits for the year were about $600. The lines of this company take in Beamsville, Jordan and Silverdale. The rental to subscribers is $10 per year.

At the annual meeting of the Welland County Telephone Company held recently in Bridgeburg, it was reported that during the year one hundred new telephones had been added to the system, making a total of eight hundred and twenty five. The company now owns one hundred and twenty five miles of lines in Welland county, and this year were able to pay a dividend of 6 per cent. Mr. G. H. Pettit, Welland, is president of this company, and Mr. F. W. James, Bridgeburg, is general manager.

The Automatic Electric Company of Chicago have been awarded a contract by the Alberta Government for an automatic telephone equipment to be installed in the city of Medicine Hat. This contract provided for the immediate installation of 2,000 lines of central office equipment and 2,000 automatic telephones complete; the ultimate capacity of the exchange is to be arranged for 5,000 lines, and in view of the fact that Medicine Hat is growing rapidly it is contemplated that additional equipment will be required for extensions soon after the first apparatus is installed. The work on the equipment is already under way and delivery will be made within the next 150 days. This is the fourth installation of automatic equipment to be made by the Alberta Government for public exchange service, other installations having been made in Calgary, Lethbridge and Strathcona, in addition to which the city of Edmonton operates a municipal automatic exchange.

The Auburn Power Company Development

An Installation on the Otonabee River Possessing Many Interesting Features—Another Link in the Chain of the Electric Power Company's System

By Mr. R. T. Jeffery

In the early history of power development in Peterborough, a woollen mills company obtained water rights on the Otonabee river, from the government, at a point which at that time was situated north and just outside of the city limits. A few years later a timber dam with stone piers was built at this point and the power obtained was utilized for driving a woollen mill on the east side of the river and also to generate power which was supplied to the city of Peterborough. Later, the power plant was bought out by the Auburn Power Company who operated for a number of years, utilizing water from the old Auburn woollen mill dam. The old equipment of the Auburn Power Company consisted of one 250 kw., 2,300 volt, three-phase, 60-cycle generator and exciter, one 100 kw. and one 40 kw. unit, the two latter units being 550 volt d.c. compound-wound railway generators. These were all driven by water wheel and power and light were distributed in Peterborough as well as power to the Peterborough Radial Railway Company. About three years ago the Auburn Power Company was purchased by the Electric Power Company including the water rights of the Auburn Woollen Mills Company and a larger development was planned to economically utilize the minimum flow of the river at that point. In October, 1910, work was commenced on an entirely new and up-to-date plant which was completed and placed in operation about a year ago. In the following pages we give a brief description of this plant with some of the more important details regarding its hydraulic and electrical design.

The hydraulic features of the development comprise the following: (a) main dam and intake; (b) head canal; (c) power house; (d) tail race.

Main Dam and Intake

The main dam is located opposite the Auburn woollen mills and about 1,200 feet north of the power house. It is a concrete structure consisting of piers and stop log sluices. The piers are each 6 feet thick and the sluices each 20 feet wide, with the exception of the log slide which is 9 feet on a slope of three horizontal to one vertical, with two piers, each 4 feet thick. The maximum height of the dam is 24 feet and the total length from east to west abutment is 452 feet including the intake to the head canal, which occupies a total width of 99 ft. 6 ins. at the west shore. The dam is constructed on solid limestone foundations but is designed to resist upward pressure, if water should percolate between the base and the foundations—or through the seams in the rock below. The piers are extended to the full height of the dam to provide for the construction of a street railway crossing at some time in the future, see figure. Each sluice has a depth of 10 feet below normal head water level, and thus provides a total discharging capacity of 26,000 cubic feet per second. The area of the water shed above the dam is 2,821 square miles, and the flow from this area is well regulated by the works of the Trent Canal. The area of the storage pond is approximately 20 acres. At the west end of the dam is located the intake, which consists of four stop-log openings each 20 feet wide and 10 feet deep, and separated from one another by piers 4 ft. 6 ins. thick. The total width of the platform for operating the stop logs is 14 feet. The stop logs for both intake and dam are handled by means of chain winches which can be pushed along on rails provided for this purpose.

Head Canal

The total length of the head canal is 1,200 feet, and it lies parallel to the river between the dam and the power house. The excavation was made up of approximately the following qualities: solid rock, 1,453 cubic yards; loose rock, 2,270 cubic yards; common, 8,399 cubic yards. The section of the canal for some 400 feet below the head works has a solid rock bottom 74 feet wide with a concrete wall on either side. The section between 400 feet and 970 feet from the head works was common and loose and solid rock excavation and is 86 feet wide at the top. Part of this section has a solid rock bottom and the remainder is covered with 6 inches of reinforced concrete, as shown in an accompanying figure. The sides which slope 1½ to 1 are also covered with reinforced concrete 9 inches thick. The 230 foot section immediately above the power house is 83 feet wide, the bottom being solid rock with concrete walls on either side. In the head race wall at the face of the racks is situated an ice run 20 feet wide, see general view, the level of which is regulated by light 3 in. x 12 in. planks. The racks are 19 ft. 7 9-16 ins. long and consist of flat steel bars 3½ in. x 5-16 in. bolted together in sections 3 ins. wide with 1¾ in. spaces between

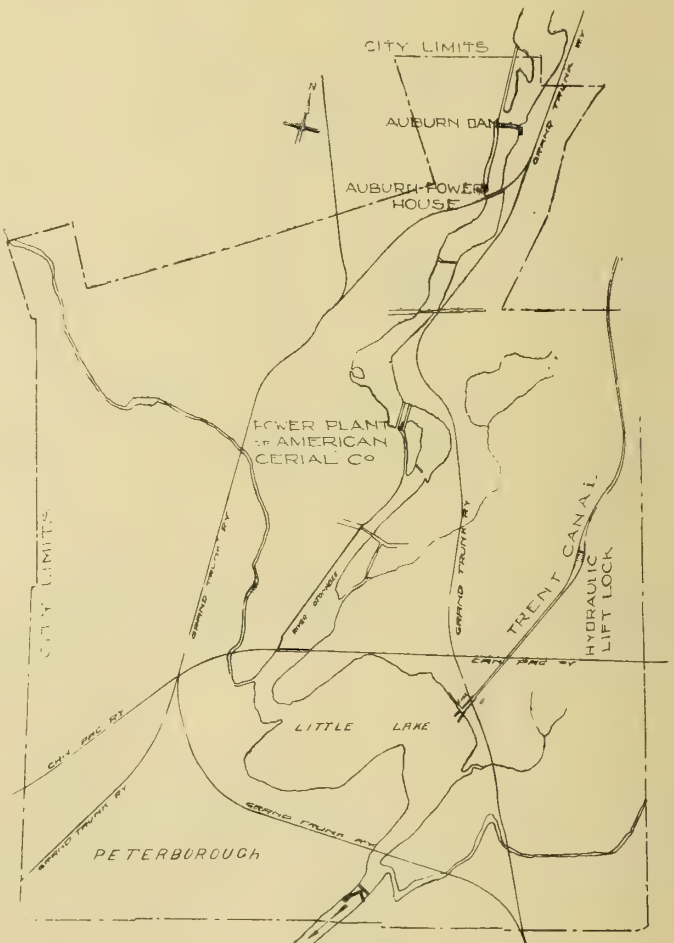
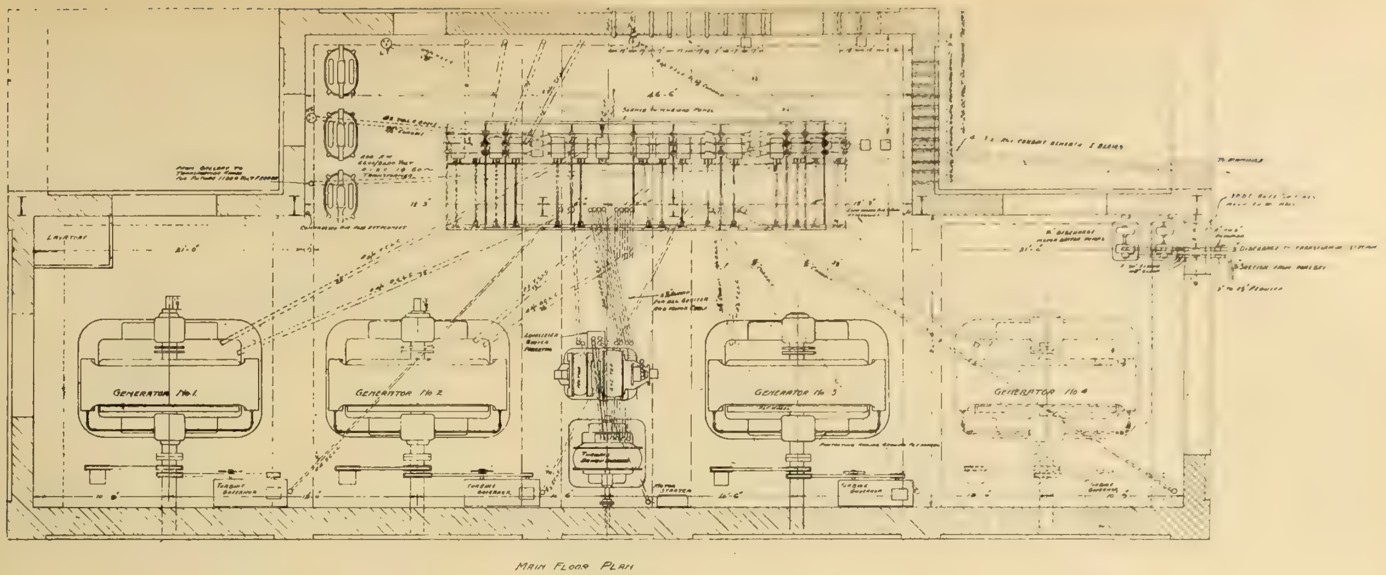


FIG. 1—OTONABEE RIVER IN CITY OF PETERBOROUGH

Showing location Auburn power plant, Peterboro



Showing main floor plan of Auburn Power Company's development at Peterboro

bars. The upper section of the racks is of wood a special design calculated to minimize ice-troubles.

A Travelling Sluice Gate

There are five wheel pits with a 3-foot wall between them. Four of these are designed for power units and in the fifth, situated in the centre of the structure, the exciter turbine unit is located. The main wheel pits are 40 feet long, 16 feet wide and 14 feet deep giving a net area at the entrance of each wheel pit of 224 square feet. The water may be cut off from the wheel pits by means of 12 in. x 12 in. stop logs, but as this operation is rather slow, and difficulty is always found in getting the stop-logs sufficiently water-tight to empty the wheel pits for repair or examination of the turbine gates or runners, a specially designed travelling sluice gate has been provided by means of which the water can be stopped off from any wheel pit in a few minutes. This gate is 15 ft. 3⅝ ins. wide and 14 ft. 3 ins. high, and is constructed of riveted boiler plate carried by a travelling gantry constructed of structural steel and mounted on four cast iron wheels 2 feet in diameter, the wheel base being 9 ft. 8 ins. and the rails a standard width 4 ft. 8½ ins. The gate itself is fitted with circulating rollers at each side to run in the concrete stop-log gains. With this arrangement it can be lifted or lowered under a full head of water with the turbine gates wide open. Leakage when the gate is closed is reduced to a minimum by means of adjustable skin side-bars which serve as guides and are set into place after the gate is closed. The gate is moved along the rails by means of a hand gear, but is arranged to be raised or lowered either electrically or by hand, and is fitted with a self-sustaining brake. It is capable of being lifted or lowered by means of the motor in 2¼ minutes against quick running water passing through the opening under the maximum head available and under the same conditions may be lowered by hand in four minutes, or lifted by hand in sixty minutes.

The Power House

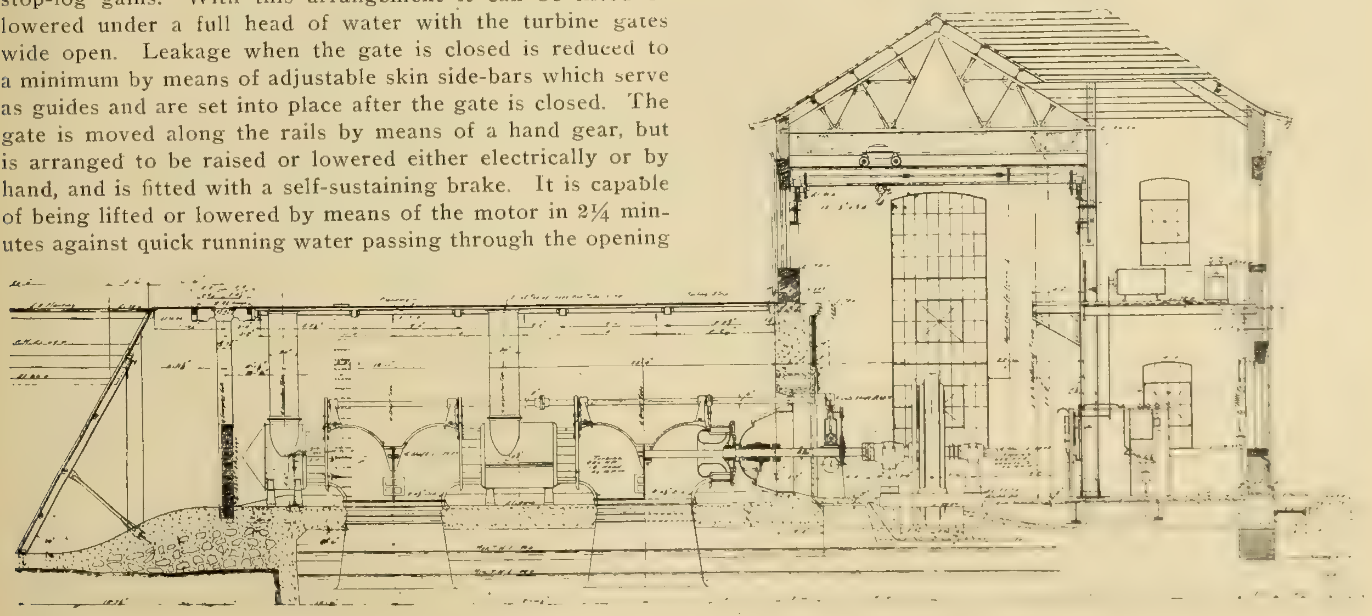
The power house substructure is composed entirely of reinforced concrete, 3,439 cubic yards being required for its construction. The inside dimensions of the power house are 88 ft. x 21 ft. 6 in. x 32 ft., with a bay in the centre of lower side of the structure 14 ft. x 46 ft. 6 ins. The roof is covered with red tile which in addition to its durable qualities adds considerably to the artistic appearance of the building.

The Tail Race

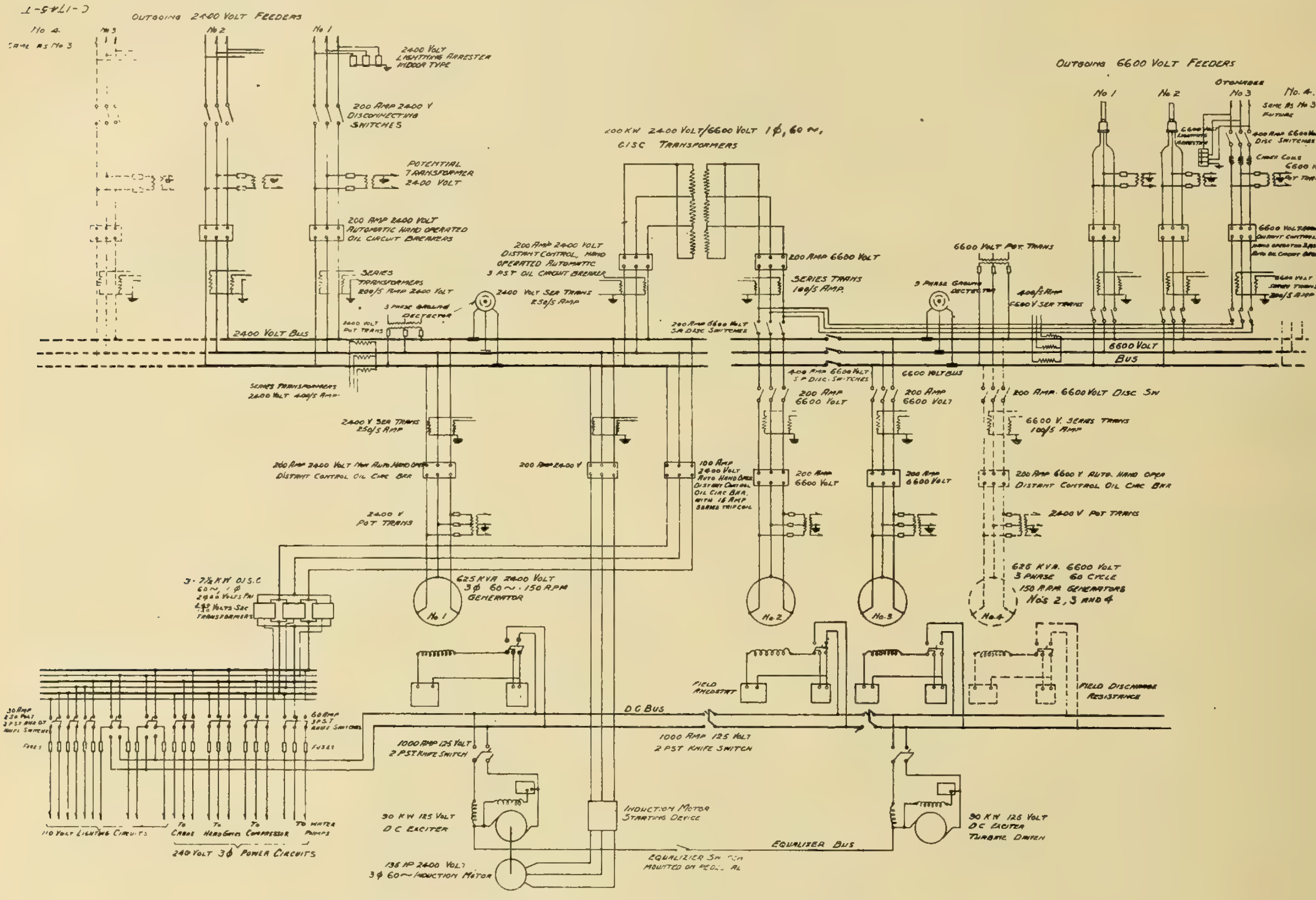
The discharge openings from the wheel pits are 16 ft. wide with 3-foot walls between them and the water may be cut off from the wheel pits by means of 12 in. x 12 in. stop logs. The tail race is approximately 250 feet long and is a rock excavation. The tail race passes under the G. T. Railway bridge just before it joins the river.

Hydraulic Equipment

There are at present installed three four runner Sampson horizontal turbine units with a maximum capacity of 950



Sectional plan through power house—Auburn Power Company, Peterboro h.p. at 18 feet head and 150 r.p.m. having a maximum efficiency at 700 h.p. The guaranteed efficiency is 80 per cent. at ⅞ gate, 82½ per cent. at ¾ gate, 82½ per cent. at ½ gate, and 73 per cent. for ¼ gate. After the turbines were installed they were tested for capacity at normal head and efficiency at various gate openings. In making these tests, a suitable load was obtained by the use of a 6,600 volt water rheostat located in the tail race and the water which passed through the turbine was measured at the stop log gains in the tail race by means of a Price current meter.


C-1745-T
Outgoing 2400 Volt Feeders
No 4.
Same as No 3
No 3
No 2
No 1
2400 Volt Lightning Arrester Indoor Type
200 Amp 2400 V Disconnecting Switches
Potential Transformer 2400 Volt
200 Amp 2400 Volt Automatic Hand Operated Oil Circuit Breakers
Series Transformers 200/5 Amp 2400 Volt
3 Phase Ground Detector
2400 Volt Pot Trans
2400 Volt Bus
Series Transformers 2400 Volt 400/5 Amp
200 Amp 2400 Volt Distant Control, Hand Operated Automatic 3 P.S.T. Oil Circuit Breaker
2400 Volt Ser Trans 250/5 Amp
200 KW 2400 Volt/6600 Volt 1φ, 60 ~, C.G.E. Transformers
200 Amp 6600 Volt
Series Trans 100/5 Amp.
200 Amp 6600 Volt S.P. Disc Switches
6600 Volt Pot. Trans
3 Phase Ground Detector
400/5 Amp 6600 V Ser Trans
Outgoing 6600 Volt Feeders
No 1
No 2
Otonabee
No 3
No. 4.
Same as No 3 Future
6600 Volt Lightning Arrester
400 Amp 6600 Volt Disc Switches
Choke Coils
6600 Volt Pot Trans
6600 Volt Series Trans 200/5 Amp
6600 Volt Bus
400 Amp 6600 Volt S.P. Disc. Switches
6600 Volt Bus
200 Amp 6600 Volt
200 Amp 6600 Volt
200 Amp. 6600 Volt Disc Sw
6600 V. Series Trans 100/5 Amp
2400 V Ser Trans 250/5 Amp
200 Amp 2400 Volt Non Auto Hand Oper Distant Control Oil Circ Bkr
200 Amp 2400 V
100 Amp 2400 Volt Auto Hand Oper Distant Control Oil Circ Bkr. with 15 Amp Series Trip Coil
200 Amp 6600 Volt
200 Amp 6600 Volt
200 Amp 6600 V Auto. Hand Oper Distant Control Oil Circ Bkr
2400 V Pot Trans
2400 V Pot Trans
625 KVA 2400 Volt 3φ 60 ~ . 150 RPM Generator
No. 1
No. 2
No. 3
No. 4
625 KVA. 6600 Volt 3 Phase 60 Cycle 150 RPM Generators No's 2, 3 and 4
3 - 7½ KW C.G.E. 60 ~, 1φ 2400 Volts Pri 240/120 Volts Sec Transformers
Field Rheostat
Field Discharge Resistance
D C Bus
30 Amp 250 Volt 2 PST Knife Switches
60 Amp 3 P.S.T. Knife Switches
Fuses
Fuses
1000 Amp 125 Volt 2 PST Knife Switch
1000 Amp 125 Volt 2 PST Knife Switch
110 Volt Lighting Circuits
To Crane
To Head Gates
To Compressor
To Water Pumps
240 Volt 3φ Power Circuits
30 KW 125 Volt D C Exciter
Induction Motor Starting Device
136 HP 2400 Volt 3φ 60~ Induction Motor
Equalizer Bus
Equalizer Switch Mounted on Pedestal
30 KW 125 Volt D C Exciter Turbine Driven

Wiring diagram—Auburn Power Company's generating station, Peterboro

The turbine runners consist of steel plates, the gates and guides of cast iron, the draught tube ring of cast iron, and the draught tube of steel plate. The bearings are lignum vitae, and babbit ring oiled type. Each unit has two cylindrical inspection tubes with a step ladder fastened to the inside to permit of the bearings being easily inspected.

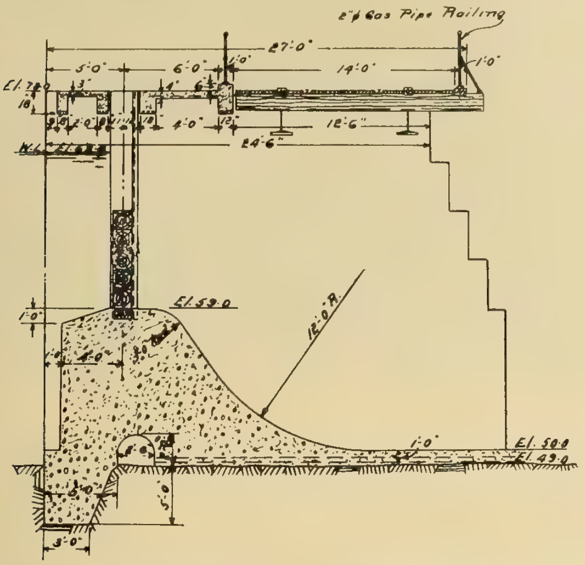
The exciter turbine consists of two 26-in. Sampson runners mounted on a horizontal shaft and is capable of delivering 170 h.p. at the generator coupling at full gate when operating under 18 feet head and at normal speed of 275 r.p.m. The runaway speed of the turbine is 425 r.p.m., and the efficiency at full gate 80 per cent.; at ¾ to ⅞ gate approximately 82 per cent. There is no governor on this unit, and the maximum pull on the hand wheel required to open and close the gates completely is 40 lbs.

The speed of each of the 950 h.p. turbines is regulated by a governor supplied by the Lombard Governor Company. The piston of the governor is connected directly to the turbine gate shaft by means of a connecting rod and crank, without intermediate gears, and the governor is capable of moving the gates of the turbine through their full range, either opening or closing in two seconds. The governors are also supplied with a device which will close the gates automatically should the governor belt break or any accident happen to the pump, and will readjust the gate opening if the speed varies more than ½ of 1 per cent. from normal. The maximum energy given by the governor in opening or closing the gates is 17,000 foot-pounds. Each governor is supplied with a control motor and also a control switch located in the generator panel by means of which the station operator is able to control the speed of the unit close enough for synchronizing the generators. All the turbines were supplied by the Wm. Hamilton Company of Peterborough.

Electrical Equipment

The generators were provided by the Canadian General Electric Company. No. 1 unit is a 625 kv.a. unit wound for 3-phase, 60 cycle, 2,400 volt operation at a normal speed of 150 r.p.m. The other two units are of the same capacity as No. 1, but are wound for 3-phase, 60 cycle, 6,600 volt operation at a normal speed of 150 r.p.m. A full load efficiency of 94.4 per cent., regulation of 6 per cent., at 100 per cent. p.f., and temperature rise of 40 deg. C. at 80 per cent. p.f. is guaranteed by the manufacturers. The rotor consists of a cast steel spider with a forged steel rim to which the field poles are bolted. The specified fly-wheel effect of the generators is 400,000 lbs. feet, and in order to reach this figure a fly-wheel was keyed to the shaft close to the rotor. Placing the fly-wheel in this position inside of the generator base, saves considerable floor space. The generators were given a runaway speed test in the factory at 255 r.p.m. for 15 minutes, with full load field current at 80 per cent. p.f.

After the generators were installed heat runs were made on each unit at full load and 80 per cent. p.f. and also at 1¼ full load 80 per cent. p.f. The load was obtained by means of the 6,600 volt water rheostat located in the tail race, and the proper power-factor was obtained by running one of the other generators in parallel with the generator being tested as a synchronous motor and varying its field to get the required power-factor. These tests showed the temperature rise of generators to be well within the contractors' guarantees.



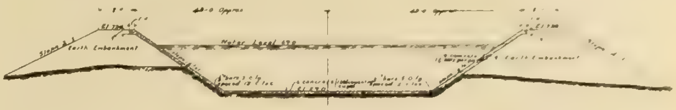
Section through spillway of main dam—note railway tracks

Exciters

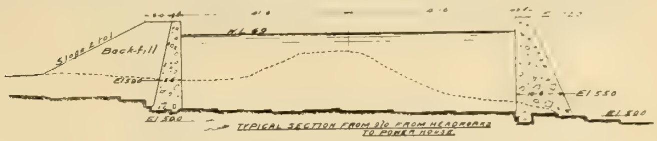
There are two exciter units of Swedish General Electric type supplied by Messrs. Kilmer, Pullen and Burnham. One consists of a 90 kw., 125 volt, 275 r.p.m. compound-wound, horizontal shaft, water-wheel type generator. The other unit is a motor-generator set consisting of a 90 kw., 125 volt, 860 r.p.m. compound-wound d.c. generator, direct connected to a 135 h.p., 3-phase, 2,400 volt, 60 cycle slip-ring type induction motor, the set having two ring oiled bearings. Both these sets are guaranteed by the manufacturers to carry full load with a temperature rise not exceeding 40 deg. C., and tests after installation showed that they will operate well within these values.

Switching Equipment

The switching equipment was supplied by the Canadian General Electric Company. All the panels are of blue Vermont marble, and the 2,400 volt and 6,600 volt busbars, current and potential transformers, feeder disconnecting switches and oil switches are mounted on a pipe frame work structure behind the switchboard with a passage way between. The instrument wiring is carried to the panels in conduit, making a very safe installation as no voltage higher than 125 volts is brought to the switchboard. Wooden gratings laid on rubber mats are placed on the floor at the front and rear of the pipe bus structure, and rubber mats in front of the switchboard. All instrument covers, oil switch tanks, pipe frame work, cable sheaths and bells, and generator frames are thoroughly grounded.



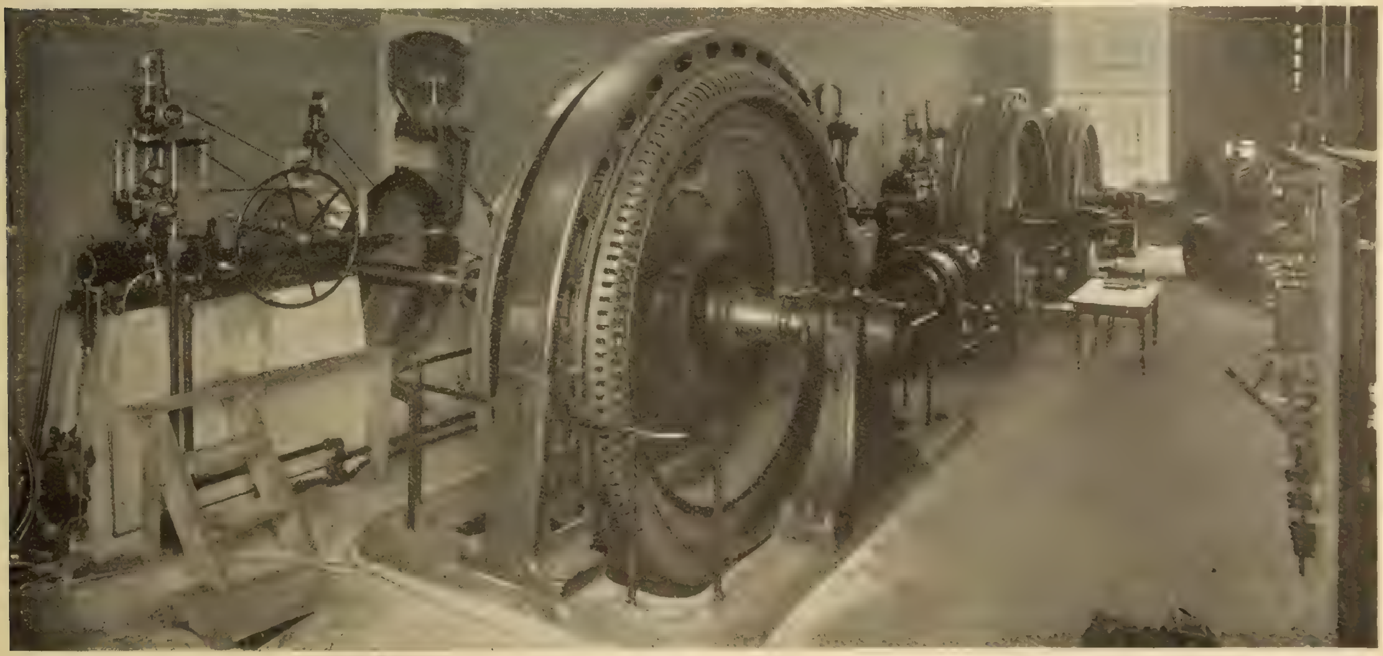
Typical section of head canal, Peterboro



Typical section of head canal, Peterboro

Situated at the west end of the switch bay are three 200 kv.a., 6,600-6,300-6,000/2,400-2,300-2,200-600 volt single-phase self-cooled transformers. The primaries are wound so that they can be connected in delta or Y and when Y connected can be operated from an 11,000 volt circuit.

The 2,400 volt generator is connected so as to feed the north end of the city in the vicinity of the station at 2,400 volts and the three 200 kv.a. 6,600/2,400 volt transformers are so connected between the 2,400 and 6,600 volt busses that this generator may be used to supply power to the 6,600 volt busses through these transformers as well as to the local distribution system at 2,400 volts. With this arrangement 1,000 kw. may be fed out of the station to the local distribution system at 2,400 volts, or the total output of the station may be fed out at 6,600 volts to the 44,000 volt transformer to be stepped up to the transmission line voltage. The



Interior Auburn Power Company's generating station, Peterboro

A General view of the Auburn Power Company's generating plant, showing head canal,

generators are connected to the oil switches through lead covered cable and they may be synchronized at the switchboard by means of the motor-operated governors.

The plant of the Otonabee Power Company which is situated a few miles further up the river and is owned by the Electric Power Company, is run in parallel with the Auburn station as is the plant of the American Cereal Company from which the Electric Power Company purchase a block of power at 2,400 volts, as well as power to drive a 200 kw. and a 100 kw. 500 volt d.c. belted railway generator to operate the electric railway of the Peterborough Radial Railway Company. These railway generators are situated in the power house of the Cereal company and are each belted to one of the a.c. units.

Transformer Station

From the 6,600 volt busses feeders in lead-covered cable run to the transformers station where the power is stepped up to 44,000 volts and transmitted over a single circuit, 3-phase, 4/0 aluminium line to Port Hope, where the h.t. line is tied in with the remainder of the Electric Power Company's system. The transformer building has three pockets 12 ft. 6 ins. x 12 ft. with a 14-in. wall between the pockets 21 ft. high. The lightning arresters and h.t. oil switch are located at the north end of the building through which wall the h.t. lines pass to the switch tower of the h.t. line. The h.t. bus-bars run up over and across the wall between the transformer pockets and are supported on insulators. On the east side of the building is an extension 11 feet wide by 30 feet long, in which are located the oil tank and water filters.

Switchboard, busstructure and gallery

The substructure of the transformer building is concrete while the superstructure is structural steel and pressed brick. The roof is concrete covered with a roofing compound. There is no crane supplied for lifting the transformer core and coils out of the tanks, the idea being to construct a track leading from the front of the transformer building to the power house. When it is necessary to disassemble one of the transformers it will be run out of the pocket on to a special truck which has been designed for that purpose and run down to the power house, where it can be disassembled on the erecting floor of the generating station. This scheme permitted the transformer building being made very much narrower and lower than it would have been had it been designed with an erecting floor and crane. There are at present installed two 1875 kv.a. 6,600-6,300-6,000/44,000-42,000-40,000-38,000 volt O.I.W.C. transformers. These transformers were supplied by the Canadian General Electric Company and have a guaranteed temperature rise of 40 deg. C. at full load. One of these transformers is at present being used as a spare.

Auburn transformer station

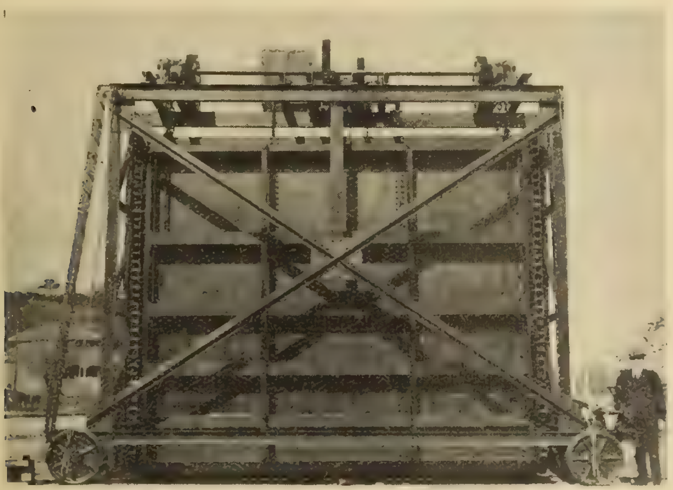
That part of Peterborough that is not being supplied with 2,400 volts power direct from the generating station is supplied from the Otonabee sub-station in which are installed 6-250 kv.a., 6,000/2,300 volt oil insulated, self-cooled transformers, and one 750 kv.a., 6,600-6,300-6,000/2,400-2,300-2,200-

spillway, sluice gate, power house, tail race and transformer house in background

600 volt oil insulated, self-cooled transformer.

It will be seen that with the above described connection, Peterborough is sure of an excellent service from the local plant, and in addition is also connected in with the Electric Power Company's system through the h.t. line which runs to Port Hope.

The construction works in connection with installing the plant was done by the Midland Construction Company. The sub-contractors in the general works were Clarke & Monds, Trenton, and on the structural steel work Mackinnon, Holmes & Company, Sherbrooke, Que. The work was done according to the designs and under the supervision of Messrs. Smith, Kerry & Chace, consulting and operating engineers of the Electric Power Company.



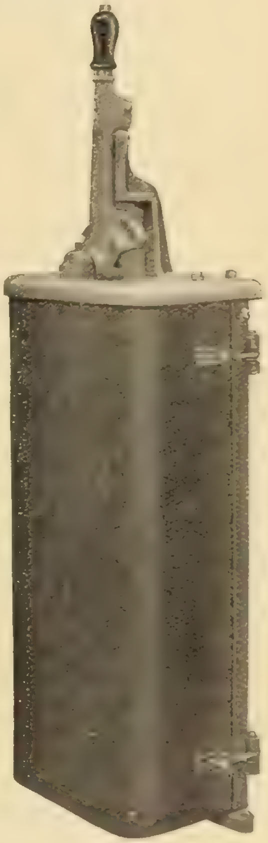
Emergency sluice gate, Peterboro

Third and Fourth Reports

The third and fourth annual reports of the Hydro-electric Power Commission of the province of Ontario for the year ending October 31st, 1911, is just to hand. The reports outline the results that had been accomplished to that date under the following headings: 1. Acts and agreements; 2. Transmission system; 3. Construction of stations; 4. Operation of systems; 5. Hydraulic investigations; 6. Municipal work. In addition to a quantity of valuable information the reports contain some forty-five excellent illustrations of the Commission's system.

New Features in Drum Type Controllers

Sometimes the location of drum controllers makes operation by a straight backward and forward motion of the operating handle a little more convenient than the usual rotary motion in a horizontal plane. The Cutler-Hammer Manufacturing Company, Milwaukee, have, therefore, standardized a vertical arrangement of lever with bevel gear drive that can be applied to the six different current types of enclosed drum controllers and the three alternating current types. The accompanying illustration shows this straight line drive, the lever having a centering latch released by means of the button at the end of the handle as in the case of the horizontal rotating type lever. The operation is very easy and the milled star wheel and notched lever permit all points of control to be distinctly felt. The construction of the drum, non-stubbing fingers, are deflectors, cylinder, etc., remains as in the original line of controllers which was brought out about two years ago. Special arrangements can also be made for rope operation.



The Oshkosh Manufacturing Company, in order to take care of their rapidly increasing business in Indiana and Illinois, have opened a branch house at 410-426 South Clinton street, Chicago. It is felt that this will be a great convenience to Chicago customers as the new branch will carry a complete line of the well-known Oshkosh tools. This branch house will be in charge of Mr. R. L. Thayer.

James Beggs & Company, 36 Warren street, New York, announce that over 600,000 horse power of Blackburn-Smith Feed Water Filters and Grease Extractors are now in service.

Lightning Troubles on High Tension Lines

A Discussion of the Effect of Lightning Discharges with an Argument in Favor of the Condenser Type of Arrester—The Mosciki Condenser

By Mr. N. W. Lofvengren

The expression "lightning troubles" is hardly correct, as in general the trouble referred to can be either atmospheric or from an internal creation on the system. The troubles met with in practice are, (a) static troubles; and (b) atmospheric surges.

Static Trouble

This trouble is due to wind, rain, sleet, etc., creating an accumulation of static electricity in various portions of the lines, and the voltage continually mounts until it reaches such a point that it is able to puncture the insulators supporting the lines. It is of a continuous current nature, and these accumulations of electricity can occur at several places on the line, and from a variety of causes, such as already mentioned, the friction from wind or sleet, big differences of elevation when the line passes through a valley and then over a mountain, differences of temperature between sunrise and sunset, etc. These troubles, we find, are not particularly common in Canada, but in such places as Mexico, California, etc., much trouble is met with in this respect.

Again, where the line passes over a well timbered country with good earths from rivers or loamy soil, this danger is considerably lessened. Where the line is perched on high and dry rocky ground, quartz or otherwise, with bare earths, this trouble can become very dangerous, and also where the line passes through long reaches of very dry sandy prairie land, which means bad earths and little means for the disposition of the accumulation of static electricity.

The proper course to take to protect against this trouble is to connect the line to a permanent path for the passage of this accumulation, which should be, therefore, a path of very low resistance, thus permitting the easy passage of the continuous current (in other words the accumulated static electricity), but not permitting any appreciable quantity of current at the ordinary periodicity of (say) 25 to 60 cycles. The only apparatus that can do this is one whose resistance increases as the periodicity, making use of the well-known principle of induction. Such an apparatus consists of a choking coil wound on an iron core, immersed in oil, with one terminal to connect to the line, and the other to connect to the earth.

Before proceeding, it must be borne in mind that this apparatus has nothing to do with the choke coil in series on the line as the principle of the line choke coil is quite different. This inductance coil does not carry the main line current at all, and is arranged to have a big choking effort to prevent the flowing of any line current. At the same time, the low ohmic resistance allows an easy passage direct to earth for the flowing of the continuous current which accumulates on the line and prevents a rise to any big potentials.

In regard to the installation of these coils they should be placed, of course, at points where there is liable to be any big potential accumulations, such as at the lower end of the line in a valley and the higher end of the line on top of the mountain, or, say, in prairie land between mile sections and always, of course, at the sub-station or power station.

The installations in the sub-stations and power houses are usually sufficient in Canada, where, being fairly well wooded in the general run of cases, with good earths, it means a big saving as regards trouble from this source.

This trouble is generally the most serious in all countries, and certainly is in Canada. It is the result of atmospheric storms, and causes the breakdown of machinery far more than of line insulators, for reasons given below.

In the first place, let it be understood that the condenser type of lightning arrester does not protect against a direct stroke on the line, nor is there any apparatus on the market that does protect against a direct stroke. A direct stroke is not particularly dangerous to the apparatus in the station, insofar as its effect is strictly local, shattering insulators, overthrowing poles, etc., but not proceeding along the line to the station.

The High Frequency Surge

The most dangerous phenomenon is the comparatively low voltage, high-frequency surge that is set up when a discharge occurs between neighboring clouds or between clouds and earth, in a direction more or less parallel to the line. This atmospheric discharge is of an oscillatory nature, similar to the discharge that occurs in the Leyden jar, and the oscillations are of an extremely high frequency and induce in the line a secondary high frequency surge. Besides the ordinary oscillographic measurements, this is proved in many ways, as for example, in the interference of atmospheric storms with wireless telegraphic apparatus. During an atmospheric storm, signals are received by wireless receivers of an obviously atmospheric nature—so much so on many occasions as to exclude the possibility of ordinary signals being transmitted,—and seeing that the apparatus used with regard to wireless work is only tuned to periodicities of 100,000 to 1,000,000, and cannot respond to periodicities either below or above, it is obvious that these interferences must be of some intermediate frequency.

Again, a condenser which cannot pass appreciable currents except at periodicities greater than 100,000 has been connected to lines, and a fuse placed in series with the condenser. On the occasion of a heavy atmospheric discharge, as much as a 40 amp. fuse has been blown, and seeing that, to allow 40 amps. to pass, the frequency of the current to get through the condenser must have been at least 250,000 (resistance of a condenser varies inversely as the frequency) it is obvious that atmospheric disturbances are of a high frequency nature. There are many other proofs of this.

To continue, assume that, due to a discharge between clouds, high frequency surges have been created in the line and are propagated along until they reach the sub-station or a generating station, as the case may be. During their propagation along the line, they, of course, gradually use up their energy and the amplitudes of the waves are gradually decreased. If the point of creation is more than fifteen to twenty miles from the station, in all probability the surges will have become so flattened down as not to be dangerous to the gear inside the station, and the energy of the surge will have expended itself in the ohmic resistance of the line and also the skin effect, which, of course, is a very great item when dealing with high frequency currents.

Assuming, however, the point of creation is considerably closer,—say one or two miles from the station—the surge tension reaches the station with quite a large voltage of, say, a maximum of 3,000 or 4,000 volts on a 13,000 volt line, for example. Now this surge tension being so much lower than that for which a 13,000 volt arrester would be set (the setting is generally 15,000 volts), it cannot get across the horns or gaps, whichever may be used, according to the type of so-called arresters. This surge tension, however, continues on, sparks across or passes through the choke coils (according to the type—see notes later on), and reaches the terminal of, say, the transformer. Now the windings of a transformer simply constitute an ordinary condenser (in which the ohmic resistance can be neglected) in-so-far that one has copper, insulation, and then iron core—that is, two conductors with insulation in between. The whole length of winding, of course, constitutes the total capacity to earth of the transformer, and it can be proved that the conductivity to earth of the transformer is equal to $\sqrt{(L/C)}$ where

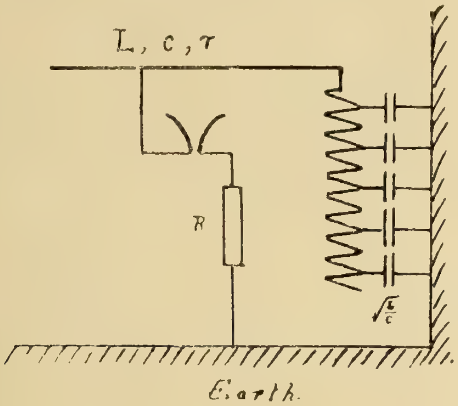


Fig. 1

L equals the inductance in henrys and C the capacity in microfarads of the winding.

Now owing to the high frequency nature of the current, it is absolutely impossible for it to penetrate the turns very far, and it generally localizes itself on the first, second or third turns. This means that the only passage to earth, then, is that given by the first few end turns.

Now, the frequency of this surge tension being so high, the wave length, is very very small, and between two or three turns there occurs a maximum positive and maximum negative of surge tension, and if the amplitude of the surge tension is 2,000 volts, this means that between two or three turns we get a difference of potential of 4,000 volts. Now though the end turns of a transformer are usually wound with extra heavy insulation to stand surges between turns, and normally the turns between windings should carry a difference of voltage of say 20 or 30, with the extra insulation we will allow them to carry three or four times as much and say, therefore, that they are supposed to be able to withstand 100 volts between turns. In any case, it is seen how utterly useless this is, as 4,000 volts are just about as dangerous when applied to turns which normally can withstand 100 as when applied to turns which can only withstand 20 or 30. It means the insulation is punctured in any case, and after two or three recurrences of this puncture the insulation will be so weakened that on the next occasion line current will flow, and a burn out results, and down goes the end coil of the transformer or alternator, as the case may be.

Operation of Arresters Valueless

It may be argued that the arresters have been seen to discharge, which we will admit, and we will take the case, of an arrester, whether of the horn with resistance in series, the multigap or the electrolytic type, in operation, and prove that usually the operation is valueless.

Assuming that the voltage of the surge tension was sufficient to get across the gap, it is at once seen that we have two paths in parallel for a discharge to earth—one through the arrester and one through the winding of the machine, as described above. We attach herewith the algebraic expressions, showing the results of the two paths connected in parallel, and the total conductivity thereof, and the reduction coefficient is given finally by the expression

$$\frac{R}{\sqrt{(L/C)} + R}$$

where R equals the resistance in series with the arrester and $\sqrt{(L/C)}$ is as given above (See Fig. 1). This can be demonstrated as follows:—

It has been shown that as regards the transmission of waves, a line is equivalent to an ohmic resistance of the value $\sqrt{(L/C)}$. When an oscillatory current I_1 flows, the surge tension is given by $I_1 \sqrt{(L/C)}$. Assuming the arresters have operated, there are two paths in parallel for conducting the discharge, of resistance R for arrester, and $\sqrt{(L/C)}$ for machine. The total equivalent resistance, therefore is

$$\frac{R\sqrt{(L/C)}}{R + \sqrt{(L/C)}}$$

so for a current I_1 flowing to earth by two parallel paths, the surge tension becomes

$$I_1\sqrt{(L/C)} \times \frac{R}{R + \sqrt{(L/C)}}$$

and the reduction is given by the factor

$$\frac{R}{R + \sqrt{(L/C)}}$$

By practical measurement $\sqrt{(L/C)}$ is always equal to approximately 600 ohms. Therefore the reduction coefficient equals

$$\frac{R}{600 + R}$$

Now in considering the resistance which is permissible to be in series with horns, it must be borne in mind that we must not have the resistance too low as it would pass considerable line current, and if very low would practically constitute a short circuit to earth. This, of course, is obviously inadvisable. We must have, therefore, the resistance high enough to prevent the excessive line current flowing to earth, and also to prevent a second phenomenon of resonance.

Now resonance occurs when we have fairly high inductance, high capacity, and low ohmic resistance. With the winding of the transformer, therefore, and high frequency current, we have a tremendous inductance, and as already explained, only utilizing a very little insulation resistance at the end turns, we have a very high capacity. These, combined with the resistance in series, including, say, a low resistance arrester sets up resonance, or in other words a high frequency surge of the very nature we wish to avoid.

This has often been demonstrated—for example, in southwestern Ontario, where they use horn gaps with oil immersed resistance—and on the occasion of a lightning discharge the arresters operate three or four times in succession very rapidly. Now the discharge from lightning only occurs once so that the next two or three times is simply the result of resonance, and the re-establishment of the arc itself. This is also often noticed in the charging of electrolytic arresters, where, after charging, the current is finally ruptured on the horns and the abrupt rupture sends oscillations up and down the line, on occasion causing the circuit breaker to trip, as has occurred at various points in Ontario. The reason for this is given later.

In any case, it can be mathematically proved that the resistance in series with an arrester must be greater than twice $\sqrt{(L/C)}$, as follows:—

Assume V equal to the voltage for which the arrester is set, and E equals the nominal line voltage. V equals aE where a is a constant. When the apparatus operates the current I flowing is expressed by $I = V/R$ and surge tension when this breaks is

$$I \sqrt{(L/C)} = \frac{V \sqrt{(L/C)}}{R}$$

To avoid the possibility of creating a surge tension big enough to re-establish the arc, the following must be fulfilled

$$\frac{V \sqrt{(L/C)}}{R}$$

must be less than V (the setting voltage).

Therefore R must be greater than $\sqrt{(L/C)}$.

Owing to the uncertainty of the value of $\sqrt{(L/C)}$, and in order to provide against the above, R must be greater than $2 \sqrt{(L/C)}$.

Take a 1,000 kv.a. station, 10,000 volts, and R equal to 2,000 ohms using the formula

$$\frac{R}{R + 600}$$

For R = 2,000 ohms, reduction coefficient = 0.77
For R = 3,000 ohms, reduction coefficient = .83
For R = 5,000 ohms, reduction coefficient = .90
For R = 10,000 ohms, reduction coefficient = .94

Owing to the uncertainty of $\sqrt{(L/C)}$ this resistance must never really be taken less than 2,000 ohms, say for a 10,000 volt line, and even this figure constitutes a pretty dangerous feature. With this figure, therefore, and R equal to 2,000 ohms, we have worked out the reduction coefficients and it is seen, that the modification of the surge tension is 23 per cent., 17 per cent., etc., down to practically nothing at all. This modification is utterly valueless as 3,000 volts are just as dangerous when applied between turns which should only carry twenty or thirty, as is 4,000 volts. It is only on very rare occasions too that a modification of 23 per cent. of the surge tension occurs, and practice proves that the modification is rarely above 5 per cent. to 10 per cent.

Proper Apparatus a Condenser

The only apparatus, therefore, that is theoretically and practically correct is one whose resistance varies inversely as the frequency. That is to say, for low periodicity and continuous current, there is no line current passing, but on the super-position of a high frequency surge from any cause whatsoever, the apparatus presents a good easy path to earth. The only apparatus that fulfills this condition is an ordinary condenser.

The difficulty in past years has been the successful design of these condensers, to avoid excessive heating, due to continual connection to the line, and various other things. In the "Mosciki" condenser the problem has been successfully solved, and the condensers can be connected to the line without more than four or five degrees C. rise.

These condensers consist of a hydraulic flint glass tube, with a neck narrowed at one end, about 30 ins. long, and 2 in. diameter, silverplated inside and outside, and reinforced with a copper plating outside the silver. A suitable insulator is mounted on the narrow end and connections taken to the internal coat. The external coat is connected to the earth frame of the apparatus. The whole tube is fitted in a block brass tube, and is hermetically sealed, so that there is nothing visible but the insulator. The block brass tube is filled with a mixture of glycerine and water, so as to uniformly distribute all heat due to di-electric hysteresis. Several of these tubes are mounted in parallel, according to the size of the station to be protected, but the minimum is six, and the maximum 24. These condensers have been successfully built and operated continuously on lines up to 60,000 volts.

Each condenser tube has its own fuse, so that should one get a particularly heavy discharge, its fuse will blow. It is practically impossible for more than one fuse to blow at a time, and we might add that it is a very rare occurrence when these fuses do blow—say only once or twice a year during an exceptionally heavy storm. It is, of course, advisable to have some periodic inspection and cleaning, which is necessary with any electrical apparatus. The blowing of one fuse however does not put the apparatus out of commission, and only means that until the fuse is replaced, the other tubes have slightly heavier duty. For the ordinary discharge one tube is amply sufficient, so that there is a factor of safety of at least six and on many occasions considerably more, and a fuse is really only a protection for the apparatus itself, preventing its being punctured on the occasion of excessive discharge. As already mentioned, it is only on very rare occasions that the fuses are ruptured.

In conjunction with this arrester choke coils are used, which again are slightly different from the usual make. They are of course helical in construction, and not disc type, for the disc type choke coil is utterly valueless. It is at once seen that in the disc type choke coil there are layers of copper and insulation, simply forming the equivalent of a condenser and high frequency surges coming in from the line, strike the outer layer and are propagated, as under ordinary conditions in a condenser, through the metal and insulation to the centre, so that there is absolutely no choke effect at all. In fact they constitute little more than the equivalent of a resistance in series with the line so far as the high frequency surges are concerned.

The helical type of choke coil as adopted by the General Electric and Westinghouse is, we believe, correct, and the Mosciki design is the same, except that they go one step further, and instead of using copper or aluminium wire, utilize iron wire, so as to take advantage of the higher resistance—the greater skin effect of iron and the magnetic properties all combining to give a far bigger reflective effort on the line. The coils, of course, are proportioned suitably to carry the line current, and again one need not fear that there is any excessive volt drop under ordinary working conditions, as this volt drop is dependent entirely on the impedance over normal frequencies. These coils have a slightly less impedance than those of other makers, and therefore the voltage drop is rather less than with other makes.

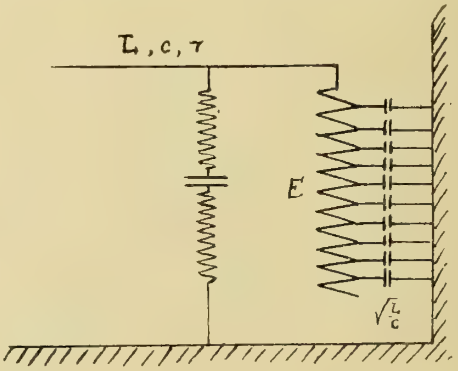


Fig. 2

Another point is the isolating of the arresters from the line during inspection, cleaning, etc., and one must fully appreciate the fact that a capacity circuit must not be abruptly disconnected from the line. This often causes great trouble, as in the case of the electrolytic condenser during charging. There is, therefore, supplied with these arresters slow break switches, which slowly disconnect the apparatus from the line through a gradually increasing resistance of a mixture of water and glycerine.

The Effect of a Battery of Condensers Placed Between Line and Earth

In Fig. 2 is represented a line, having self induction, capacity and kilometric resistance (L.c.r.) the winding of a machine E and a lightning arrester in the form of a condenser having the capacity g and connected to earth through a wire having the self induction d and an earthplate with the resistance p. We have again to calculate the equivalent resistance of these two paths to earth.

The calculation is often employed in telegraph and telephone work, but we content ourselves with simply giving the result of this calculation. We have examined different cases according to the value of the resistances presented by the earth-plates, and according to the self-induction of the earth wire and we give below a table which shows the reduction coefficients for discharges having frequencies between 100,000 and 1,000,000, assuming that the condenser battery is one of our standards with twelve tubes.

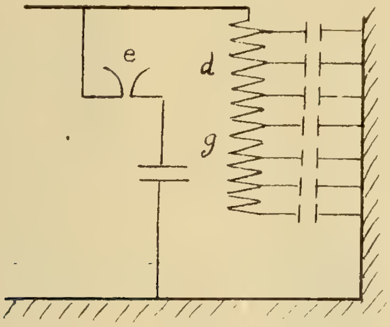


Fig. 3

Resistance of Earth Wire	Self-Induction of Earth Wire	Reduction Coefficient at different Frequencies			
		100,000	250,000	500,000	1,000,000
0	0	0.067	0.027	0.013	0.007
5	$2/10^6$henrys	0.065	0.024	0.009	0.016
5	$2/10^5$henrys	0.041	0.028	0.092	0.205
50	$2/10^5$henrys	0.093	0.087	0.128	0.225

An examination of this table shows us that we no longer deal with a reduction to about two-thirds of the original surge tensions, as was the case with horn arresters, but that we easily arrive at such enormous reductions that only from 2 per cent. to 6 per cent. of the surge tension remains if there is a good earth plate and if the self induction of the earth wire is small. To reduce such a condenser battery to a similar low efficiency to the horn arrester, the frequency would have to be as low as 2,000 periods and we have shown that at this periodicity, surge tensions are no longer any source of danger. The table also clearly shows the very great importance of minimising the resistance of the earth-plate and the self-induction of the earth wire, and this leads us to the conclusion that the majority of installations of protective apparatus have greatly failed on these points

It is not necessary, as stated by several persons, that the capacity necessary for protective purposes should be of the order of that of the line; it must only be taken somewhat higher than the capacity of that portion of the line which corresponds to a half wave-length of the high frequency wave. With a frequency of 100,000 periods, for example, we need only consider the capacity of 1,500 meters of line, and for a frequency of 1,000,000 periods that of 150 meters; the protection is evidently the same for a line of 100 km. length as for a line of only 10 km. length, because we deal here with forced oscillations and not with free oscillations.

It has also been stated that it was dangerous to place condensers on the line because, in that way, the capacity of the line was increased, but if this were the case, one should never construct overhead lines which have more than .01 mf. per kilometer, and cables which have .2 mf. or twenty times as much would be impossible. From this point of view it would not be permissible to increase the length of any given overhead transmission because an additional 5 km. of overhead line or 200 meters of cable would correspond in capacity to one of our condenser batteries.

Observations on the Electrolytic Condenser with Spark Gaps

From Fig. 3 it may be seen that as soon as the spark gap operates, we have a resonance circuit constituted by the condenser, the gap and the winding, which of course is a very dangerous arrangement and also retains the disadvantage of horn arresters, viz., that it cannot came into operation before the high frequency tension has attained a value corresponding to the adjustment of the arrester. A great deal has recently been published concerning the employment of an electrolytic condenser for protective purposes. This device consists of a number of electrolytic condenser elements arranged in series, each element being formed by two suitably shaped aluminium discs which are separated by the electrolyte. For pressures which are below the "forming" pressure the system acts like a condenser; for higher pressure, the condenser punctures and acts like a capacity shunted by an ohmic resistance. When the pressure becomes reduced again the electrolytic condenser automatically reforms. If therefore the tension increases much above that which is normal, this kind of condenser is entirely broken through and the resistance R in Fig. 4 is then only the resistance of the electrolyte. As soon as the surge tension has disappeared the condenser begins to form up again and the resistance increases until it attains an almost infinite value.

One can imagine the three following possibilities with this arrangement, Fig. 4.:—

1. When the arc breaks and the value R is infinite, the apparatus acts like a condenser with a spark gap in series, and produces resonance effects because no appreciable ohmic resistance is arranged between the condenser and earth.

2. When the condenser has broken through owing to the surge tension, and is not reformed when the arc breaks, the resistance R, being practically that of the electrolyte, is very weak and the conditions are as though a short circuit to earth had been broken. If I is the value of this current, the resulting surge tension will be I $\sqrt{(d/g)}$ which may be an extremely high voltage.

3. If the condenser has broken through owing to the surge tension and is only partially formed up again when the arc breaks, the resistance R may have any value. If it is very small, that is to say only a few tens of ohms, we have practically the preceding case; if it is larger, that is to say a few 100 ohms, then the condenser still operates as a badly insulated condenser and produces resonances. It therefore follows that the apparatus is always dangerous. It would not be the same if it could be connected to the line without a spark gap in series, but this cannot be done because electrolytic condensers rapidly deteriorate under alternating pressure.

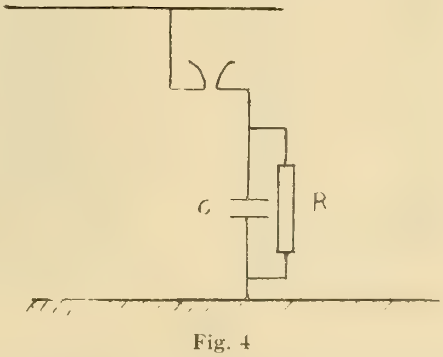


Fig. 4

Another great disadvantage with these electrolytic condensers is the necessity of "forming" them every day by connecting them for a few seconds to the line.

While the above described condenser is suitable for high frequency currents it is not equally applicable to medium frequency discharges and another type of apparatus known as the Giles Valve has been devised to take care of discharges under the more moderate conditions. This trouble is one that is created internally on a system, due to hunting of machinery, the abrupt opening of a circuit breaker, the sudden charging of a cable, etc. These troubles are generally more in evidence when a wave form contains the third and fifth harmonic. These frequencies, of course, are much too low to enable us to use a condenser, and in the ordinary way the usual tension limiter is utilized, which consists of a gap .with a resistance in series. Now the same arguments apply with regard to this tension limiter as given to the above arresters, namely, that if the resistance is made too low, a danger of resonance is constituted, creating the very trouble you wish to avoid and if too high, the effectiveness is very very limited, and not at all valuable. The apparatus used, therefore, is a spark gap, with resistance connected to earth through condensers. This allows the setting of the gap to within one or two per cent. of the line voltage if necessary. It also enables the use of comparatively little wire as there are several elements in parallel. On the occasion of a potential rise at the terminals of a generator or cable, a discharge occurs, current passing down through the resistance wire, and charging up the first plate of the condenser. The moment a plate of this condenser reaches any big pressure, it sparks across to the next condenser, and the same action is repeated until finally the earthed plate is reached, when the energy expended in the various spark gaps, etc., by the two or three elements in parallel prevent an abnormal rise.

The great advantage of utilizing these condensers is that during every half period the arc is absolutely extinguished, and needs no accessory apparatus to blow the arc out. Also, there is absolutely no possibility of the arc hanging on in the main spark gap, as the resistance is not connected directly to earth, but through a series of small condensers, which in themselves have a big insulation resistance. It is only the sparking over of the edges of these plates which gives the connection to earth and at the same time automatically extinguishes it when the wave passes through a point of zero potential. Under these conditions the Giles Valve is surprisingly effective and reliable.

In Fig. 5, the winding of an alternator is shown diagramatically with its capacity against the frame uniformly distributed. I, I, denotes a double pole automatic oil switch. Assume that the alternator feeds on a line on which a short circuit develops. At this moment the alternator produces a current in this short circuit which is approximately three times the normal current. In the case of turbo alternators, this short circuit current may amount to 30 to 40 times the normal current.

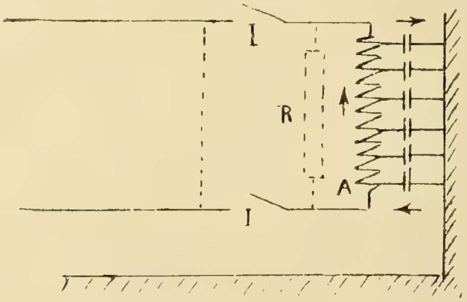


Fig. 5

If we denote by l the induction of the alternator, by I the normal current and by I_1 the short circuit current, then the energy which is stored in the winding of the alternator will be $\frac{1}{2} l I_1^2$.

Since the automatic switch breaks this circuit suddenly, it follows that this stored energy will not have time to flow off through the line and a surge tension is the result because the only path through which this energy can flow off is that formed by the capacity of the machine itself (as shown by the arrows). The maximum surge tension will then assume the value $I_1\sqrt{(l/c)}$.

Suppose now that we place the resistance R in shunt with the oil switch; the stored energy has then two paths through which it can flow off, viz., through the capacity of the machine against earth and through the resistance R. The winding of the machine with its uniformity distributed self-induction and capacity is equivalent to a line except that the values of these constants are different. Messrs. Ivan Dory, Devaux-Charbonnel and others have shown by different and independent methods that a line of this nature is, as regards the propagation of electric waves equivalent to a simple ohmic resistance having the value of $\sqrt{(l/c)}$.

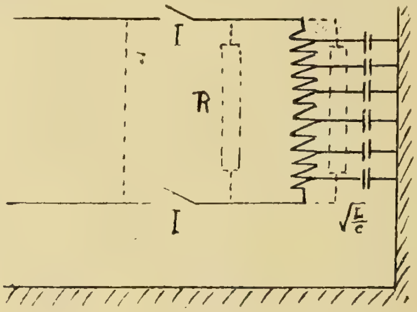


Fig. 6

This is true in all cases where the value of $\sqrt{(l/c)}$ is appreciably greater than the ohmic resistance of the machine, i.e., whenever free oscillations are able to develop in the line, i.e., frequencies above 2,000 per second. In Fig. 6 the discharge capacity of the alternator is replaced by a shunt resistance and under these conditions the calculation becomes identical with that which we have made above in the case of high frequency current; the resistance of the two discharge paths will be

$$\frac{R\sqrt{(l/c)}}{R+\sqrt{(l/c)}}$$

If at the instant when the automatic switch breaks the short circuit, there be a current of I_1 flowing, then the maximum surge tension at the terminals of the alternator will be

$$\frac{I_1 R\sqrt{(l/c)}}{R+\sqrt{(l/c)}}$$

$I_1\sqrt{(l/c)}$ is again the maximum theoretical surge tension without limiting device and therefore the reduction factor introduced by the protective apparatus is again as above,—

$$\frac{R}{R+\sqrt{(l/c)}}$$

The same things happen on the other side of the automatic switch, that is to say, on the line side. Before the short circuit is broken the cable carries the short circuit current and a certain amount of energy is stored in the self induction of the cable; at the moment of break, this energy which can no longer flow off to the alternator, can only be stored in the capacity of the cable and oscillates to and fro between the self-induction and the capacity until absorbed by the ohmic resistance of the conductors.

The effect produced by a tension limiter placed across the ends of the line is identical with that which we have just calculated for the case of an alternator and the reduction factor for the surge tension is again

$$\frac{R}{R+\sqrt{(l/c)}}$$

the only difference is that in this formula l and c stand respectively for the kilometric self-induction and the capacity of the cable.

Other phenomena may also occur in cable systems; there may be accidental resonances due to the harmonics of the machines and the capacity of the cables, but in this case the natural oscillation frequency is only 3, 5 or 7 times the normal frequency of the alternator. For these very low frequencies we may neglect the capacities of the alternators as against their self-induction and the self-induction of the cables as against their capacity and we have then a very simple case where a self-induction (that of the alternators) enters into resonance with a simple capacity (that of the cables), At the point where both join, enormous surge tensions may arise. If this condition of resonance is temporary, we may deal with it by means of liberally calculated tension limiters, but if the resonance is permanent, i.e., if it is reproduced periodically, no tension limiter would be able to deal with the energy of the whole distribution system, without assuming ponderous dimensions.

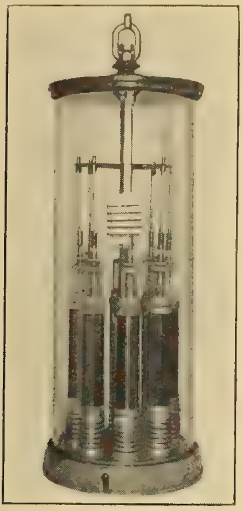


Fig. 7

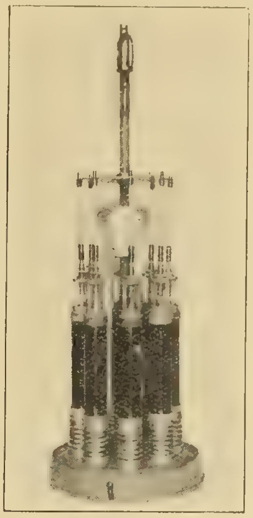


Fig. 8

Effect of the Operation of a Horn Arrester

As we have shown above, the horn arrester must be placed in series with a resistance and must fulfil two contions.

1. The resistance must be higher than $\sqrt{(l/c)}$ (the ratio being taken at its maximum value). Otherwise when the horn arrester breaks its arc it would produce higher voltages than those for which it is adjusted, and the arc would constantly re-form and keep the arrester permanently in operation.

2. This resistance must be greater than twice $\sqrt{(l/c)}$ since otherwise the conditions of non-resonance in the oscillatory circuit formed by the horn arrester, its resistance, the self-induction and capacity of the alternator would not be fulfilled and as a consequence high frequency resonance might be the result.

In practice, since the estimate of the value of $\sqrt{(l/c)}$ is not very exact, we have to take R greater than 4 $\sqrt{(l/c)}$, we have seen above that the surge tension is reduced to

$$\frac{R}{R + \sqrt{(l/c)}} = \frac{4\sqrt{(l/c)}}{\sqrt{(l/c)} + 4\sqrt{(l/c)}} = \frac{4}{5} = .8$$

Therefore, a horn arrester calculated as carefully as possible, but having a certain minimum resistance, will produce a reduction of 20 per cent. in the surge tension, that being the most favourable case. We must therefore say that such an apparatus is useless because it is easy to prove that the maximum theoretical surge tension in the case of the breaking of a short circuit may rise to 150,000 or 160,000 volts, whatever the voltage and output of the alternator.

The "Valve" or Tension Limiter

The limiter is built up of 6, 8 or 12 columns in parallel, each column being provided with an individual resistance of 800 to 2,500 ohms, according to the requirements of the case so that under certain conditions valves are supplied having a resistance as low as 70 ohms; if necessary a number of such valves can be placed in parallel. The first spark gap is made adjustable; the upper ball is fixed to the end of a screw with a 2 mm. pitch so that this gap may be accurately set, and in order to protect it against the deposition of dust or foreign matter this gap is enclosed in a small glass cylinder.

The other spark gaps are fixed and consist of suitably shaped flat discs, which have a considerable cooling surface so that the sparks always take place between cold electrodes and therefore are easily extinguished without special blowing arrangements. The small condensers are placed inside the columns and are not visible in the photograph, Fig. 7. Each column is connected to an upper paralleling disc through the medium of a high tension fuse, which would cut out any column in which, by some mischance, the insulation had been pierced. The whole of this valve is enclosed in a large glass cylinder, as a protection against dust and also to prevent any of the parts being touched.

This valve shows the following advantages:

1. It is possible to provide it with a total resistance as low as may be required for the effective discharge of low frequency surges, without introducing any danger from resonance troubles.

2. It assures the extinction of the sparks (caused by the surge tension) at every half period.

It is owing to this feature that it has been possible to wind the resistance with only a few grams of wire because the energy to be discharged represents only a fraction of a calorie and may be easily absorbed if we take care that the line current does not pass through for any appreciable time. With other appliances, such as the horn arrester, which take a few seconds or several hundreds of half periods before the arc breaks, the energy to be dealt with represents tens of calories so that we are obliged to put heavy and cumbrous resistances in series, which are, besides, quite useless in dealing with surge tensions, because their ohmic value has to be too high.

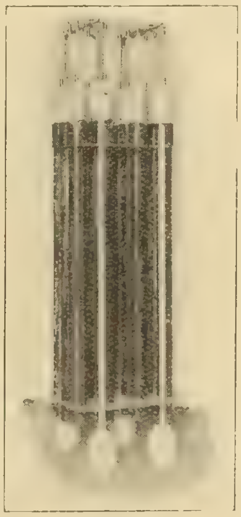


Fig. 9

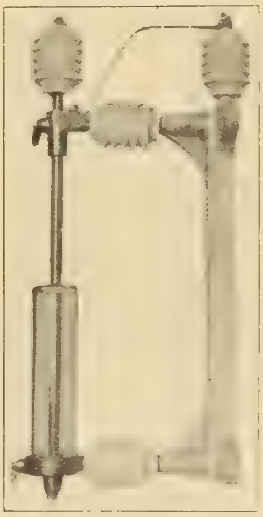


Fig. 10

Fig. 7 represents the Giles Valve with glass cover installed; Fig. 8 the same with cover removed. Fig. 9 shows the Mosciki condenser, 18,000 volt type; Fig. 10 the slow-break condenser switch for 18,000 volt service.

Apparatus for Improving Power Factor

By Mr. Miles Walker, M.I.E.E.* (Con.)

Let us suppose that we wish to design a phase-advancer to be direct connected to an 800-h.p. induction motor driving a continuous current generator. If the motor has already been built, it is necessary to inquire whether its rotor is provided with a winding brought out to slip rings; and if so, whether the slip rings and brush gear are designed to carry the full-load current continuously. One could adapt a phase-advancer to almost any normal rotor winding (except, of course, a short-circuited winding) but if the current is very high and the voltage low, the cost of the advancer will be greater than where the current is fairly small and the voltage higher.

Suppose that the rotor has a 3-phase star-connected winding having a stand-still pressure of 800 volts per phase. The working current (that is to say, the current in phase with the voltage) will then be about 255 amperes, which can be collected on a comparatively small collector. To find the rotor current necessary to make the motor run at 0.95 leading power-factor, proceed as follows:—

Set off a vertical line representing 255 amperes, as shown in Fig. 8. The power-factor of an 800-h.p. 50-cycle motor running at 490 revs. per minute might be about 0.88, so that without the advancer one would have a lagging current equal to 47 per cent. of the working current. If the advancer caused the rotor to take a leading current of 47 per cent. (that is, 120 amperes) the power-factor at the stator terminals would be nearly unity. If now it is desired to make the power-factor at the stator terminals 0.95 leading, we must supply to the rotor an additional 31 per cent. of leading current, making 200 amperes wattless in all. Adding as vectors the 200 amperes wattless to the 255 amperes working current we get 324 amperes per phase for the rotor when running under these conditions. This is the current for which the advancer must be designed. If we had made the rotor with a voltage per phase of 400 we should have had 650 amperes, which would have made a somewhat more expensive, though perfectly possible, phase-advancer.

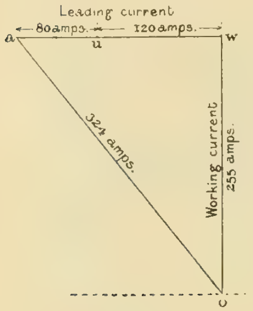


Fig. 8

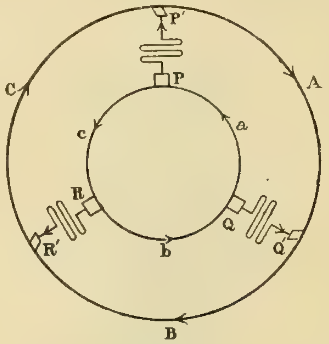


Fig. 9

Next as to the voltage to be generated by the advancer. As the armature of the advancer is to be mesh connected, it is simpler to take the voltages across the slip rings than the voltage per phase of the star winding. Indeed, as the motor would work the same whether it were mesh connected, or star connected, we may, if we like, consider it mesh connected, as we have done in Fig. 9. If the normal slip of the motor at full load be 1.45 per cent., the e.m.f. generated by the slip will be 20 volts measured between rings. Lay off as in Fig. 10 the vertical line O Ea to represent this voltage generated by the slip in phase A. In Fig. 8 we have found the angle by which the current must lead on this voltage, so we can set off the line Oa to represent the current in phase A, Fig. 9. Similarly Ob and Oc represent the currents in the other phases. We should allow about 6 volts for pressure drop in brushes and in the resistance of the advancer. This will be represented by Ea R in phase with Oa. Then there will be some reactive drop in the field coils of the advancer. We may provisionally allow 5 volts for this, and after the machine is calculated we can make a check calculation to see if it is enough. This is represented by R X. There is no reactive drop in the armature because the compensating winding wipes out its field. We see that if we add a voltage X V, parallel to b a, we shall get a resultant voltage O V in phase with Oa; and this is what we want. If, therefore, we excite the advancer with a current which is in phase with the sum of Oa and—Ob (shown by the dotted line b a) we can make the current lead by the right amount. The voltage to be generated by the advancer is therefore given by X V, which when scaled off gives us 33 volts. It will be seen that the projection of O V on the vertical line gives us O V_r which is greater than O Ea. If this voltage O V_r is greater than is necessary to drive the working current through the rotor circuit, the only effect will be that the slip of the rotor will be reduced until we get the right working current for the load. If it should come out that O V_r is not sufficient to drive the working current, then the slip of the motor will be increased.

From Fig. 10 it appears that with 33 volts generated by the advancer the slip will be slightly reduced. We thus arrive at the rating of the advancer, namely, 33 volts between terminals and 324 amperes per phase.

We have next to decide what type of advancer to build. In this case it is not necessary to adjust the amount of leading current taken from the line at all loads, nor is it necessary to control at all loads the boosting effect of the advancer. It will therefore not be necessary to install a separately excited advancer. It will be found that the series-wound advancer will have more suitable characteristics for the case in hand than a shunt-wound advancer. With a series excitation the amount of leading current taken from the line increases with the load, so that the power-factor of the motor remains more nearly constant than where the excitation of the advancer remains constant. We will therefore decide upon a series winding. Next as to the type of armature. When the voltage to be generated is of the order of 30 volts or higher, and the current is reasonably low, as in this case, the best kind of armature is that with a closed winding just like an ordinary continuous current armature.

Theoretically, three salient poles (equivalent to two magnetic poles) are quite enough for a machine of the rating required in this case, but a machine of six poles (equivalent to four poles magnetically) is more likely to fit in with standard frames and standard punchings. We will therefore decide on six poles. This will give us six brush-arms, two in parallel in each phase. There will be 162 amperes per brush arm, and 162 ÷ 1.73 = 94 amperes per conductor.

As the speed of the main motor in this case is quite high, 490 revs. per minute, it is quite a good plan to couple the advancer directly to it, just as one would an exciter to a high-speed synchronous motor. We will consider later the arrangements which can be made for low-speed motors.

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*Presented before the I.E.E.

We shall therefore take the speed of the advancer at 490 revs. per minute.

It will not be worth while to cut down a machine of this type to the smallest possible size, because the addition of a little superfluous material will not increase the cost by a very large percentage, and when we are making a machine we might as well make it so that without much further development it may be used in a large variety of cases. If we take a large $D^2 L$ constant of 9.5×10^5 cubic cm. it will not be excessive, though very ample. A diameter of 46 cm. is suitable for a speed of 49 revs. per minute, and the length of iron may be 18 cm.

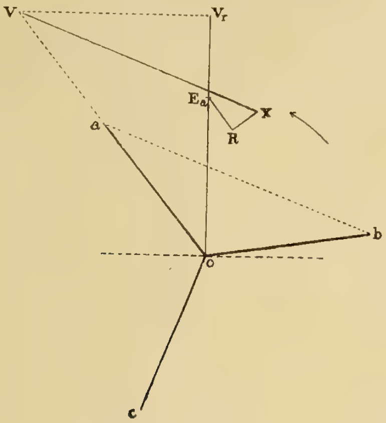


Fig. 10

The easiest way of designing a phase-advancer of this type is to proceed as if it were a continuous-current machine whose voltage is 1.41 times greater than the virtual voltage called for in the specification. The armature need not differ in any particular from a continuous-current armature. The field winding will be provided with series exciting coils and compensating windings connected to the various phases in the manner described above.

The main points to look to, that are not found in a continuous-current design, are:—

1. The machine though having six salient poles is a 4-pole machine magnetically, and we must remember this when fixing the dimensions of the iron behind the slots.
2. The voltage to be generated as a continuous-current machine is 1.41 times greater than the virtual voltage called for.
3. The fluxes in the salient poles which constitute magnetically a pole-pair are 120 deg. apart in phase, so that the voltage generated in an armature coil which lies partly under one pole and partly under another is only 0.86 of the voltage that would be generated if the two poles were carrying the maximum flux at the same time.
4. It is necessary to arrange the series winding on each pole so as to cause the flux to lead, by the right amount, ahead of the current carried by the armature conductors passing under the pole.
5. It is desirable to arrange the compensating winding so that its effect is equal and opposite to the armature winding adjacent to it, and for this purpose it is necessary to have regard to the phases of the currents in the armature and field.
6. It is desirable to provide a commutating flux which shall be proportional to, and in phase with, the current to be commutated.

We begin, then, just as we would on a continuous-current generator. The voltage to be generated is $33 \times 1.41 = 46.5$ volts. There are six ways through the armature, each carrying 94 amperes. If we choose 72 slots with 4 conductors per slot we get 288 conductors, and these multiplied by 94 give us 27,000 ampere-wires, a fairly easy current-rating for an armature 46 cm. in diameter.

If we denote the area of the cylindrical working face of the armature by Ag and the maximum flux density in the gap by B, then we may take the magnetic-loading as proportional to Ag B. If we have a pole arc equal to 0.72 of the pole pitch, then as there are 48 conductors in series and the speed is 8.2 revs. per second—

$$46.5 \times 10^8 = 0.72 \times 8.2 \times 48 \times Ag\ B \times 0.866$$

Observe the multiplier 0.866, which comes into the equation on account of the circumstance mentioned in paragraph 3. above.

Thus we arrive at the magnetic-loading $Ag\ B = 0.189 \times 10^9$. If we work the iron in the teeth at 18.500 lines per sq. cm., we shall require a total mean cross-section of all the teeth of 1,020 sq. cm. Our conductors, to carry normally 94 amperes and 25 per cent. overload, may be made 0.23 by 1.27 cm. Four of these will require slots about 0.77×3.7 cm. To provide room for 72 slots and give the necessary cross-section to the teeth we shall require a net length of iron of 16.4 cm. Allowing 11 per cent. for paper on the punchings and 0.6 cm. for a ventilating duct, we arrive at a gross length of iron of 19 cm. The rest of the calculation of the armature is the same as for a continuous-current machine, except in the matter of commutation, which we will consider later.

We must now consider how we are to wind the field poles so as to give to the excitation its proper phase. The first point to note is that the six armature circuits are connected in mesh, while the leads from the brush-holders are connected in star.

In Fig. 9 we have a diagram of connections as they would be if the machine had only three brushes. Obviously this diagram applies equally well to the machine with six brushes where brushes at opposite ends of a diameter are in parallel with one another. The inner circle of Fig. 9 represents the closed winding of the armature of the advancer. The small letters, a, b, c show the three phases mesh connected. Three brushes—P, Q, and R—bear on the commutator and convey the currents to the outer circle, A, B, C, which represents the winding of the rotor of the induction motor taken as mesh connected. It does not matter in practice whether the rotor of the induction motor is star or mesh connected, but for our diagram it is convenient to connect it in mesh. The arrowheads show the direction along each conductor which is taken as positive for the purpose of our clock-diagram, Fig. 10. P, Q, and R are in star, and it is only in series with them that we can connect the series exciting coils. The voltage in phase A of the rotor is the voltage we would measure by connecting a voltmeter to the collecting brushes P′ and Q′. In order to make the current in this phase lead, it is necessary to generate a leading electro-motive force in the part a of the armature circuit. From Fig. 10 we found that a suitable e.m.f. to inject into phase A was the e.m.f. XV, which is in phase with (a—b). From Fig. 9 we see that the current in Q is (b—a), so that — Q is (a—b). We will therefore excite the poles under which coils a are passing with —Q. The span of the armature coils is almost a pole-pitch, so that the coils in phase a will be passing under two adjacent poles, which we will call pole P″ and Q″. Now it is not convenient to use only the conductor Q to excite P″ and Q″, because we have to arrange for return paths and also for a compensating winding, and we want to make a fairly simple mechanical arrangement of the coils. We therefore take advantage of the known fact that currents $P + Q + R = O$, therefore $Q = -P - R$. Let us make an arrangement of exciting windings and compensating windings like that indicated in Fig. 11. There are exciting conductors which pass between poles P″ and Q″ are + Q, + Q, — P, —R. That is to say, they are equivalent to 3 Q. The question whether the excitation + Q gives a forward or a backward e.m.f. in a coil depends upon the direction of rotation, and also upon the question whether the armature is wound right-handedly or left-handedly. It will be seen that this arrangement of conductors lends itself to form mechanically a simple barrel winding. The conductors lie in two layers, and all the end connectors of one layer are bent to the right and all the end connectors of the other layer are bent to the left.

The letters in Fig. 11 which are placed on the salient poles represent the compensating windings. It is easy to prove that these are in direct opposition of phase to the currents in the armature under the pole. For instance, take the pole P″. The compensating winding on this is, + P + P — R — Q, or + 3 P. Now the armature coils which lie under P″ are c and — a, and we know that a — c = + P. Moreover, the 16 conductors in the pole face carrying the currents P, Q, and R are equivalent to 12 conductors carrying the P current. Opposite the pole P″ are 12 armature slots each carrying — 2 a and 2 c. When we remember that there are two paths in parallel per phase in the armature we see that the currents in these 12 slots are exactly balanced magnetically by the 12 P currents in the compensating winding.

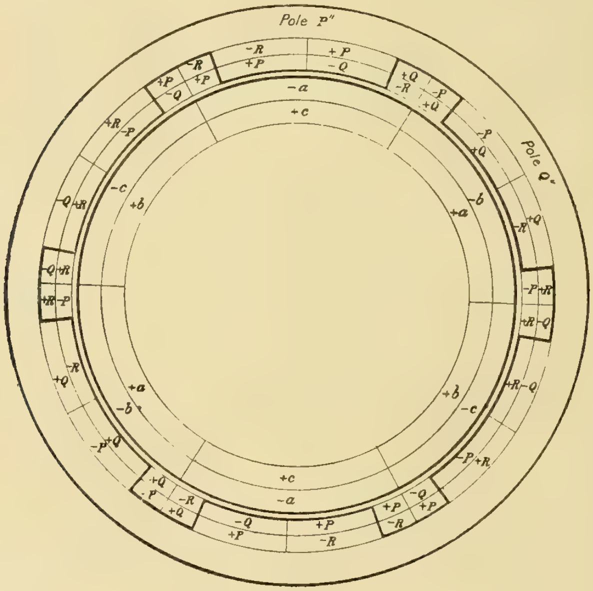


Fig. 11

It will be found that an air-gap of 3 mm. will have an apparent length of 3.6 mm. when we take into account the opening of the slots. The flux density in the gap obtained by dividing Ag B by Ag is 6,950; so that the ampere-turns on the gap will be 2,000. The ampere-turns on the armature teeth will be 510, and on the rest of the magnetic circuit about 190; so that the ampere-turns per pole will be about 2,700 or 5,400 per pair of poles. These ampere-turns are provided by the 16 conductors which thread between the poles P″ and Q″, for the 16 conductors carry current equivalent to 3 × 4 P. At its maximum P is 324 × 1.41 amperes, which multiplied by 12 gives us 5,500 ampere-turns per pair of poles. In practice it will be found unnecessary to adjust the speed exactly, because the particular power-factor at which the motor runs is not a matter of importance. It is not usually necessary to make any provision for the adjustment of the power-factor during running; it is sufficient that the motor shall take a leading current from the line at all loads. If it should be necessary to adjust the power-factor, this can be done either by changing the speed of the advancer or by diverting some of the field current from the series coils.

In cases where the speed of the motor is not great, it is more economical to belt the advancer to it so as to obtain a higher speed. In other cases the advancer may be run from any convenient countershaft in the mill where it is used, or it may be directly connected to an independent motor.

Commutation

The most important consideration of the design of the phase-advancer is the obtaining of good commutation. It is chiefly for this purpose that the field frame and winding described in this paper are provided. Where in a continuous-current generator the voltage between the bars is small, the commutation can generally be forced by the resistance of the carbon brushes; but it is very much more desirable to provide a commutating e.m.f. which shall at all times be proportional to the current to be commutated. In the machine here described this result has been effected by giving each armature coil a span of somewhat less than the full pitch and arranging the positions of the brushes so that one of the limbs of each coil is moving in the fringing field of a pole excited by a current which is at all times proportional to the current under commutation. The currents in the two branches of the armature, a and — c, which combine to form P, are out of phase with one another and are not directly under control of the commutating flux; but the rate of change of the current in the coil under commutation ought at all times to be proportional to P. Now the pole P″ (Fig. 11) is excited so that the fringing field in which the left-hand limb of the coil a is moving is at all times proportional to P. By making the coil with a short throw the right-hand limb can be taken out of the influence of the pole Q″. The exact position for the brushes is, of course, obtained by trial; in practice it is found that the commutation is perfect. The alternation of the current in the armature and field causes a harmful e.m.f. to be set up in each coil under commutation; but as the frequency is so very low (say one cycle per second), this e.m.f. is not sufficiently great to create any disturbance. In the machine under consideration it only amounts to one-sixth of a volt.

Performance

In a certain mill in the north of England there is a 250-kw. generator which on account of the low power-factor of the motors connected to it is somewhat overloaded. As it would be a rather costly undertaking to install a new generator, the alternative proposition was put forward of connecting a phase-advancer in circuit with the rotor of a certain 140-h.p. motor in the mill. It was seen that this at least would help matters, although the capacity of the motor and its phase-advancer were not great enough to bring the power-factor up to unity. A 5-kv.a. advancer was installed, with the result shown by the following figures:—

Total Load on Mill

	Amperes per Phase.	Volts.	Power-factor
Advancer cut out	325	440	0.70 lagging
Advancer connected in ..	240	440	0.92 lagging

Motor Load Only

Advancer out	105	440	0.74 lagging
Advancer in.	97	440	0.96 leading

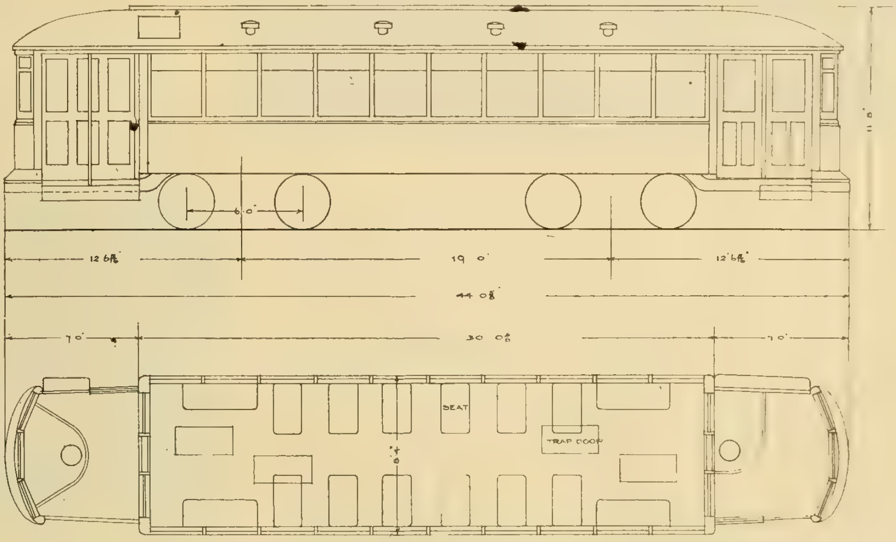
Whenever the advancer was switched in the volts of the generator rose from 440 to 470. The figures in the above table were taken after the rheostat had been adjusted to make the voltage normal.

ELECTRIC RAILWAYS

We illustrate herewith one of the street cars recently placed in operation on the municipal lines in East Toronto. This line is approximately two miles in length and four cars are operated. The rolling stock also includes a sweeper. The cars were built by the McGuire-Cummings Manufacturing Company, of Chicago. The seating capacity is 40, made up of transverse seats to accommodate 24 people, and lengthwise seats at the corners to accommodate 16, 8 in each end 4 to a side.

The general specifications of the Toronto cars are as follows: Length over buffers 44 ft.; length over car body corner spots 30 ft.; extreme height over running board 12 ft; width between posts 7 ft. 9 ins.; width over sheathing 8 ft. 4 ins.; width over all 8 ft. 9 ins.; length of platform over vestibule 6 ft. 6 ins.; length of platform over buffer beam 7 ft.; centre to centre of trucks 19 ft.

The side construction is built of 19½ by 5-16 in. side girder plate with a 3 by 3½ by ⅜ in. angle riveted to the bottom with a 2½ by 5-16 in. angle on the top. End sills are 9 in. by 15¼ in. channel riveted to the side girder plate. To the inside of the side girder plate there is a 7 in. by 14¾ in. platform knee channel reinforced on the inside with 6 in. by 1½ in. plate. The bolsters are two 7 in. by 14¾ in channel irons with plate riveted on the top and bottom. Through the centre of the car is a T iron of suitable size to support the trap doors. The car is braced diagonally under the platform with a 4 by ⅝ in. plate and at centre of car with 2½ by 2½ by ¼ in. angles and at three intermediate points across the car are located 6 in. by 8 in. channel iron. The buffer beam is a 7 by 3½ by 7-16 in. angle connected to the longitudinal platform knees with suitable connections. The floor beams are filled with oak or yellow pine nailing strips. The upper frame consists of posts all of ash. The intermediate posts are 1¾ by 3½ in. The corner posts are built up to 5⅜ inches in thickness and width to suit. The side posts are tenoned into the sill and plate and are tied together with ½ in. strap bolts with the exception of the corner posts which are ⅝ in. rods. The side plates are all long leaf yellow pine 2 inches in thickness. The vestibule posts are in one piece. The side posts are arranged so that the upper sash will be stationary with the lower sash dropping into the partition.



Sectional diagram Toronto's municipal cars

The roof framing consists of four double ash car lines with a 1½ by ⅜ in. steel car line sandwiched between. Beneath these iron car lines are five ⅞ in. ash car lines cut to contour of roof.

The car flooring is 13-16 by 3¼ in. yellow pine. The floor is double with building felt paper between. In the aisles is a 13-16 by ⅞ in. maple matting screwed to the floor with brass screws. The vestibule floor is 1⅛ in. by 3¼ in. tongued and grooved oak substantially nailed to floor nailing strip and laid crosswise of the floor, the end board being substantially framed into the oak-nose piece.

The side sheathing is 9-16 in. tongued and grooved poplar securely nailed and glued to a ¾ in. continuous blocking. The vestibule is sheathed with No. 14 B.W.G. steel. The roof is of the turtle back type ½ in. tongued and grooved poplar, painted inside and out, covered with heavy cotton duck to which has been applied three coats of lead and oil. The vestibule hoods are framed on ash car lines and have two thicknesses of ¼ in. poplar roofing covered with cotton duck. On the top of the roof there are three 1½ by 6 in. long leaf yellow pine running boards securely fastened to the roof with screws so as to prevent roof from leaking.

The vestibule is of the p.a.y.e. type though this method of collecting fares has not yet been installed. They are equipped with interchangeable railing of one inch iron pipe. The entrance doors are of triple type and equipped with Buner sliding folding door fixtures and arranged with ¾ in. pipe lockbar across the inside of the door. The exit door is operated by a lever mechanism. The inside of the vestibule is in natural wood finish. The sash in the door pocket inside the vestibule is arranged to swing open so as to give access to the door mechanism. All end windows in the vestibules are arranged to drop.

The interior finish of the car is quarter sawed oak. The wainscotting from top of truss plank over heater pipes to the arm rail is in narrow tongued and grooved well-matched material 9-16 in. thick. The car is equipped with bottom sash arranged, to drop and with a flap covering the pockets. All doors are glazed with ¼ in. plate glass. The side windows are equipped with pantesote covered curtains hung on Hartshorn rollers and friction fixtures. Doors and windows directly in rear of the motorman are equipped with a curtain so as to exclude light. The side windows are equipped with diagonal mesh guard wire covering each window for a height of approximately 12 ins. These are fastened at the corners with bevelled thumb screws so as to be easily removed or arranged so they will not rattle.

The exit rear door is arranged to slide into a pocket and has malleable iron threshold plate. The entrance door is of the double swing type with step on inside of car so as to prevent door from swinging in. The seats are rattan reversible type with 20 in. backs, grab handles and 36 in. seats. The corner seats are stationary, 56 ins. in length and are boxed in solid under the seats with a cast grating in front to let heat out.

The car is equipped with a hot water Cooper heater with three lines of 1½in. pipe down each side of the car and three coils of heat in the front vestibule. The vestibule heater pipes are covered with grilling to prevent injury to the passengers. The heater is set inside the body of the car as shown in the drawing. The vertical type in the vestibule is covered with a layer of ¼ in. asbestos and painted.

Other equipment includes sand boxes, foot gongs, trolley catchers (Knutson type), draw bars, head lights (Crouse-Hinds incandescent head light, type Z, one on each end of each car), push buttons at each post; conductor signal bells, etc. The cars are equipped each with one set of G.E. 80 four motor equipment for double end operation. Each car is also equipped with standard G.E. air brake equipment for double end operation supplemented by hand brakes, fenders of the sliding type, manufactured by the McGuire-Cummings Manufacturing Company, are installed.

Interior Toronto's municipal cars

The steps are arranged to fold up when not in use. The steps on each side of the car being mutually operated by means of a wrought iron connecting bar. These steps are lighted by five incandescents placed immediately above the passenger's head as he alights and which are automatically switched off and on by the movement of the door.

Exterior cars operated by City of Toronto

The trucks are McGuire-Cummings manufacture M.C.B. No. 10A type. The wheel base is 6 ft. 10 ins.; length of frame 9 ft. 8 ins.; top of truck bolster to rail 26½ ins. The bolster springs are the double elliptic type 28 ins. in length; equalizer springs 1¼ ins. by 7 ins. high, manufactured by the Crucible process. Wheels are cast iron, 33 ins. in diameter. Axles were made by the open-hearth process. All castings were made of tough gray iron. The journal boxes are of cast iron. The spring seats for coil springs resting on the equalizing bars are cast iron. Journal bearings are bronze for 4¼ by 8 in. journal, lined with ¼ in. babbit. The sweeper is also equipped with G.E. 80 40 h.p. motors for both motive powers and for operating the brooms.

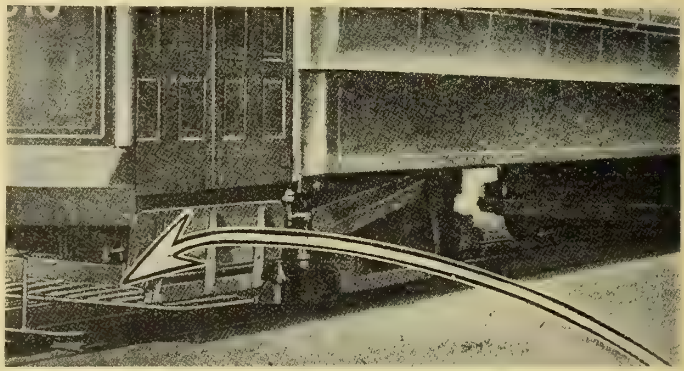
Car barn 96 ft. by 27 ft. 2 ins. has been built to accommodate these cars though it is understood this building is temporary. A five to seven minute service is being given and the cars will be operated on Sunday as soon as permission has been obtained from the legislature.

Power is obtained from the Toronto hydro-electric system through the use of a motor-generator set.

The work of construction of these lines and their subsequent operation have been under the immediate charge of Mr. C. W. Power, assistant engineer of Railways and Bridges for the city.

The Wheel-Guard Most Effective

The Parmenter Fender and Wheel Guard Company have just completed arrangements whereby their products will be manufactured in Toronto, Canada, and it is the intention of this firm to push their business actively in the Canadian field. The Parmenter wheel guard has shown its effectiveness in saving lives in a number of instances where other types of equipment would doubtless have resulted in fatalities. By attaching the wheel guard to the truck frame it follows both rails even when rounding a curve, thus giving protection where it is most needed. This method of attachment also eliminates the possibility of the guard getting broken up by striking obstructions, thus proving the advantages of truck suspended wheel guards over a body suspended guard. The accompanying illustration shows the guard under ordinary car operating conditions.



Wheel guard is suspended to truck frame

Railway Statistics for 1912

The Railway Statistics of the Dominion of Canada for the year ending June 30, 1912, is just to hand. Under the electric railway section fifty-four different roads are treated. The total length of single track is placed at 1,723.5 miles. The total outstanding stock issued against these roads is $70,829,118, the total bond issue $51,389,223, a total of $122,841,946. The total gross earnings from operation is given as $23,499,250; the operating expenses at $14,266,674, leaving net earnings from operation of $9,232,575. These figures show average operating expenses as 60.7 per cent. of gross earnings throughout the Dominion. The total number of passengers carried during the past year was 614,319,502. The total number of passenger cars in service is 2,049 closed, 866 open and 574 combination, closed and open, making a total of 3,489. Total number of freight cars operated 483, mail, express and baggage cars 33, combination cars 7, work cars 103, snow ploughs 57, sweepers 112, miscellaneous 194, bringing the total number of cars operated in Canada to 3,478. The number of passengers killed during the twelve months was 16, employees 8, others 86, total 110.

The mileage figures are evidently well within the mark at the present moment, as much extension work has been carried on since these records must have been collected. Also a number of the more recent roads have not been included, such as Lethbridge, which at the present operates about 11 miles, Regina operating 15 miles and the Niagara, Welland & Lake Erie operating 3 miles. The prospects for additions to the mileage during 1913 are very bright. At the present time the Toronto Eastern has some 25 miles practically ready for operation, with another 20 to follow early in the spring. The Toronto Suburban will probably reach Guelph during the summer. The N. S. & T. will also be operating many more miles of line. These are only examples of the way a very large number of our electric roads are expanding at the present time.

A New Rail Bond

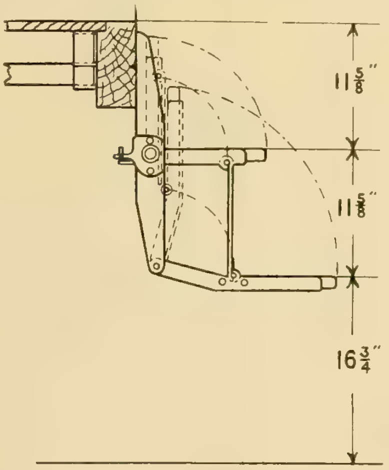
An entirely new method of making contact is used in a bond just placed on the market by the Ohio Brass Company, and known as their Type J All-Wire Rail Bond. Reference to the illustrations will show the novel features of construction. A pin is formed in the centre of an annular hole milled in the rail by a hollow cutter. This pin fits into a hole drilled in the bond terminal and, being an integral part of the rail, makes current carrying contact on the inside of the terminal in addition to that secured on the outside as in the ordinary bond. This bond is installed on the ball of the rail by driving the terminal home with a hammer. This operation compresses the copper and causes it to grip both the outer surface of the hole and the central pin. Electrically, the contact surfaces C, D and E are more than required for the capacity of the bond. The contact surface C on the pin B is absolutely protected against moisture and other corrosive elements, being far removed from the outer surface of the rail.

A special hollow milling cutter is provided for milling the annular hole in the rail. It is made of high speed steel and facilities are provided for quickly and accurately regrinding it in the field. A motor driven milling machine has been developed for use in the installation of this bond. It mills two holes simultaneously, feeding the cutters automatically. When the holes are finished, the cutters are backed out, many times as fast as they are fed in, without stopping or reversing the motor. The machine can be quickly clamped to the rail or released and is mounted on wheels for moving along the track. Two men can easily lift it from the track to allow cars to pass. The motor is especially designed for this service and operates on a 550 volt d.c. circuit with a maximum current consumption of approximately 2 amperes. The controlling switch is located on top of the machine within easy reach of the operator. Two men can mill the holes while a third cleans the holes, installs the bonds, removes crossing planks, etc.

An electric railway company who recently installed several thousands of these bonds report that under ordinary conditions three men can install from 125 to 150 bonds per ten-hour day. This bond at present is made only in 4/0 capacity and is designed for use on 60 pound and heavier rails. It is an all-wire construction, the terminals being formed of the same strands that compose the body.

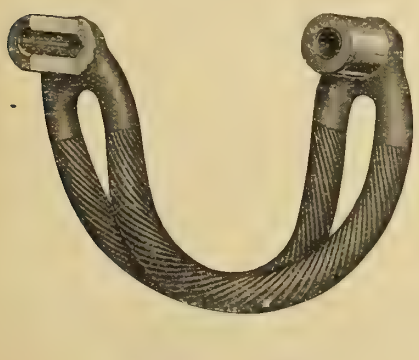
A Neat Double Folding Step

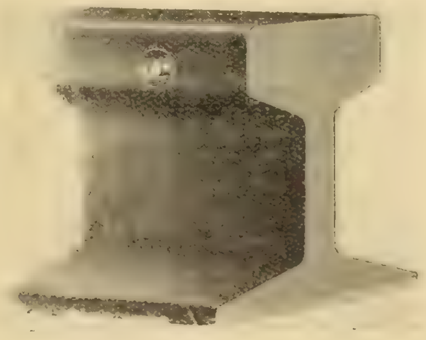
The accompanying illustration represents a type of double folding steps being used on the cars of the Muskogee Electric Traction Company. The car floors are high and the entrance and exit doors are pivoted and work in unison with these double folding steps which were rendered necessary in order to get as low a step elevation as possible. The rear entrance and exit doors and steps may be operated separately or together, and are manually controlled by the conductor through a simple system of levers.

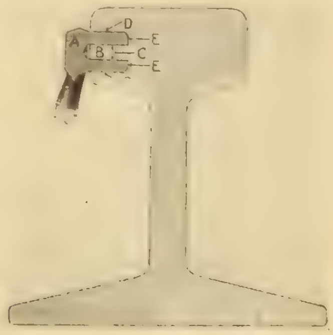


New Cars for Calgary

An order for twenty-four double truck p.a.y.e. cars has recently been placed with the Ottawa Car Company for the Calgary Municipal Street Railway. Twelve of these cars will measure 46 feet in length and twelve 41 feet. The former will have a seating capacity of 46 and the latter 42. They will be of the semi-convertible type with 18-in. x 3/8-


The new O-B bond


The annular hole in ball of rail



The bond installed

in. steel plates in side sills. The platforms are to be reinforced with 6-in. by 3½-in. steel angles. The outside sheeting and interior finish, including all window sashes and doors are to be of cherry material finished in natural wood. The roofs will be of the Moncton type with bull nose ends. The seats are standard non-reversible type, spring upholstered and covered with rattan. The heating equipment will be the Peter Smith coal fuel, hot air and ventilating system, with the heaters located in the front vestibules. The window curtains are of pantasote material with Forsythe fixtures. All trimmings, such as door handles, will be of solid bronze with bright finish. The trucks are Brill No. 27-G-I 4 ft. 6 in. wheel base with Schoen rolled steel wheels. The motor equipments are Westinghouse No. 101-B-2, four motors per car, with K-6 controllers. The air brakes are also Westinghouse type. The fenders are Providence style C. The headlights are Crouse-Hinds, type Z, with Griel frame doors. All the other appliances and equipment will be of the very latest and the arrangements will be planned so that the greatest amount of comfort can be given to the passengers. These cars will be ready for delivery early in April. The Ottawa Car Company have also received an order for six trailers from the same corporation. These will be delivered about the end of March.

St. Clair Electrification

The train service operated by the Grand Trunk Railway system through the St. Clair tunnel which connects Sarnia and Port Huron under the St. Clair river is claimed to be the heaviest railway service handled by electricity in the world. This electrification operates within a zone of approximately four miles, the motive power being derived from 1,500 h.p. electric locomotives, each weighing 135 tons with a normal draw-bar pull of 50,000 lbs. and a maximum speed of 35 miles per hour. The time taken to change engines is from two to five minutes, and the time of passing through the tunnel which, with its approaches is more than two miles in length, is 13 minutes. Up to 45 cars per train are hauled through the tunnel which represents a train more than one-half mile in length.

During the twelve months of 1912 the company's records show that 197,801 loaded freight cars and 86,692 empties passed through the tunnel, in addition to 35,096 passenger cars. Estimated on a basis of 17 tons per car, this gives a total tonnage passing through the tunnel of approximately 3,500,000. These figures do not include any company material such as coal, lumber, ties, etc., which would swell the total to much larger proportions.

N.W. & L.E. Railway

At a recent meeting of the Niagara, Welland and Lake Erie Railway Company, Mr. T. R. Cummings was engaged as engineer, and plans were decided on to carry out the construction of the whole line during the coming summer. There will be about thirty-six miles of track running from Niagara Falls to Welland and Port Colborne, and then east along the lake shore to Fort Erie.

The extensions in the town of Welland on North Main street to Parkway Heights, on East Main street to Rosedale, and south into Crowland, will also be built during the summer. Material is now on hand for these extensions and construction will commence as soon as the weather will allow. It is probable that that portion of the suburban line from Welland to Dain City and Port Colborne will be built first, but it is hoped the whole line will be in operation this year. It is understood that the new engineer has already taken up his duties and is preparing for a start on a final survey of the line.

Mr. Jeffrey is Manager

Mr. W. K. Jeffrey, who has been acting manager of the Ottawa Car Company since the death of Mr. James Buchan, was appointed manager on February 1st. Eight years ago Mr. Jeffrey joined the Ottawa Car Company as apprentice to the car building trade. He was then twenty-four years of age, and by sheer perseverance and ability has risen to his present position. For about two years and a half he was in the car shops. Then he went into the draughting office and after about a year and a half there, was promoted to the position of acting manager. Mr. Jeffrey is a native of Kinburn, Ont. Prior to coming to Ottawa he engaged in building and contracting in his home village.

Miscellaneous

The representatives of a number of municipalities who met in Toronto towards the end of January to discuss the possibility of a municipally owned and operated electric railway system connecting Toronto with a number of towns to the north as far as Port Perry and Uxbridge, have approached the Dominion government for a subsidy of $6,500 per mile. The idea of building the line was enthusiastically supported by Toronto and the other municipalities represented.

The street car system of Fort William and Port Arthur will have a deficit for the year 1912 of approximately $7,500. This is according to a report recently submitted by Mr. M. C. Wilson, secretary-treasurer of the Port Arthur and Fort William electric railway system. In future the night fare of 10 cents will be collected after 11 o'clock on this system.

The Toronto and York Radial Railway Company have made application to the Ontario government for power to enter into an agreement with the city of Toronto for the double tracking of Yonge street from the C.P.R. tracks to York Mills, terms to be settled by the Ontario Railway and Municipal Board.

The city council of Hamilton and the street railway company have reached an agreement providing for the extension of the street railway system in the north-eastern and south-eastern parts of the city of Hamilton. It is estimated by the company that the expenditure will be approximately $500,000.

Owing to certain delays in obtaining the signatures of the interested parties to the street railway agreement, it is not expected that the by-law with reference to the street railway franchise can be submitted to the citizens of Medicine Hat before the middle of March or the 1st of April.

Encouraging reports of increased revenue come from Nelson, B.C. For the week ending January 7th. 1913, the receipts were $223.35, as against $142.40 a year ago, and for the week ending January 14th, the receipts were $159.30, as against $127.95 for the corresponding week in 1912.

Mr. J. E. Hutcheson, manager of the Montreal Tramways Company, and formerly superintendent of the Ottawa Electric Railway has been made an honorary Lieutenant-Colonel. For several years he was an officer in the 43rd D.C.O.R., and resigned as major of that regiment.

Mr. F. D. Burpee, superintendent of the Ottawa Electric Railway recently gave a talk before the Ottawa Business Science Club, on "The Organization of a Street Railway."

Illumination

Matching Colors By Artificial Light

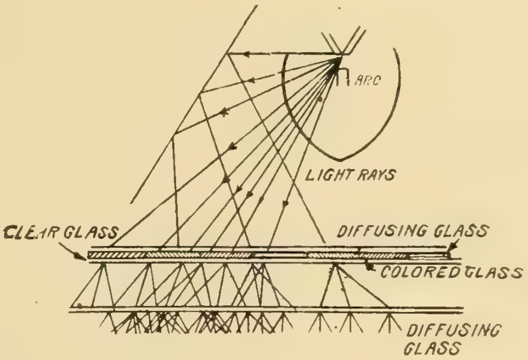
By Mr. H. L. Sheen

It is only quite recently that Illuminating Engineers have given their attention to the improvement of the color values of artificial light, the study of this important subject having been previously crowded out by quantity, efficiency, and distribution of illumination from the light giving source. At first the only consideration was quantity of light. This was followed by the consideration of efficiency and distribution, and lastly we have come to the consideration of color of artificial light. Colors matched in daylight with a standard will vary greatly with the condition of the sky; viz., sunlight, clouded sky, or clear northern sky. For accurate color matching the most constant natural standard we can utilize is light from a clear northern sky. On many days of the year such a light is not available, and even when the sky is clear, a working light is only given for perhaps six or eight hours of the working day. There has thus arisen a demand for a color matching light produced by artificial means, and after many years of careful experiment a lamp producing such a light has been put on the market in Canada by the Canadian General Electric Company.

A "Correct Color" Lamp

Such a lamp cannot be expected to have a high efficiency, nor is this of great importance, as the light is not needed for the illumination of large areas. Its greatest value at present is to provide a suitable illumination, both as to intensity and quality, over a comparatively small area, where fine and accurate color work can be done. Such a lamp has an advantage over daylight in that its color and intensity remain constant while daylight varies with the weather and time of day, a matter of a few minutes frequently making a very great difference in the apparent color value.

This color matching outfit is a modification of the standard store lighting Intensified Arc Lamp which gives a diffused white light showing colored goods very closely approaching their average daylight values. A careful examination of the spectrum of this light reveals the fact that the red and orange are slightly in excess, while the well known "carbon lines" in the violet considerably accentuate that portion of the spectrum. In other words, to bring the light to standard daylight it is necessary to reduce the amount of red, orange, and violet without appreciably weakening the color in the middle of the spectrum.



Sketch showing construction of Correct Color Lamp

A combination of several colors of glass has been obtained to give the desired light, and in order to avoid large absorption these colored glasses are placed side by side in small strips, and the emitted light is thoroughly mixed by passing through a pair of diffusing glasses placed a few inches apart, see diagram herewith. A hood with a reflecting surface surrounds the inner globe so that the light from the arc is transmitted and reflected down through the color screen, while at the same time the direct rays are kept from the eyes of the user. Two upper converging carbons and one lower carbon are employed, and the lamp proper gives a perfectly steady light of constant color value.

The practical uses of such a light are many, and this lamp should be indispensable in such places as department stores; textile mills; carpet factories; dye works; printing ink factories; lithographers; manufacturers of dye stuffs; paint factories; tobacco industries; leather industries; dental work for matching teeth, etc.

Take for instance ribbon counters and silk goods counters, and other places in department stores; it is found that the close color matching of goods is very difficult under the best of ordinary lighting conditions, and frequently impossible owing to insufficient and poor quality of light. In such places a few color matching outfits should be installed in convenient locations, where prospective customers can at any time take goods to be matched against samples, with the assurance of obtaining material of the color they actually require.

Illumination Data

A chart containing a lot of interesting information with respect to the proper placing of light units and the proper reflectors to use under different conditions has been recently prepared by the Holophane Company. The chart begins by defining the unit of intensity of illumination, that is, the "foot-candle" as the amount of illumination produced on any surface by placing a source of light of one candle-power, one foot away from this surface. The number of foot-candles required under different conditions is given in a table as shown below. It is not intended that these figures should represent any hard and fast rule, as decorations and other conditions must of necessity regulate the amount of light that is required under any given condition but they answer well in the average installation and can be followed with good results by any electrical contractor. The figures given follow:—

Desk	4	Show windows	
Draughting-room	8	Light colored goods	18
Factory, general	2-3	Medium colored goods	16
On work	4	Dark colored goods	20
Hospitals		Stores	
Wards	0.5	Art	4
Operating table	12	Book	3.5
Homes and hotels		Cigar	3
Reception-room	1.5	Clothing	5-7
Parlor	1.5	Confectionery	3
Library	2-3	Drug	3
Dining-room	2-3	Dry goods	4-5
Bedchambers	1.5-2	Furniture	5
Lobby	2-3	Furs	5-7
Auditoriums	2	Florist	3
Auto show-rooms	5	Grocery	3-4
Auto garage	2	Hardware	4-6
Ballroom	2	Hat store	4
Bank, general	2	Haberdasher	3.5
Billiard table	5	Jewelry	3.5
Cafe	2.5	Millinery	4
Church	2	Shoe	3-5

The number of foot-candles required in any installation will, of course, now depend on the number of square feet to be illuminated multiplied by the constant given in the above table. For example, take a hat store, size 40 ft. by 25 ft.; this will require 40 by 25 by 4, equals 1,000 foot-candles. The actual number of watts required will now depend further on the condition of the ceiling and walls, and the chart contains the following data with reference to these varying conditions.

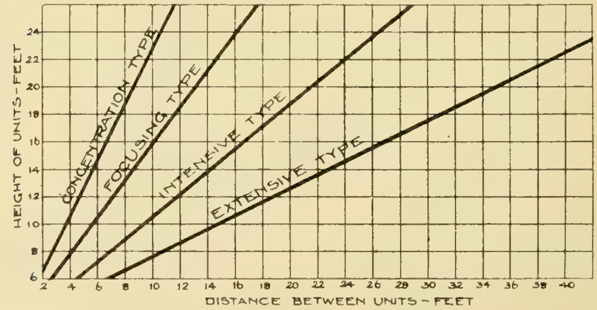


Fig. 1.

Lamps	Holophane reflectors	Ceiling	Walls	Constant
Mazda or Tungsten	Clear	Light	Light	5.0
Mazda or Tungsten	Clear	Light	Dark	4.0
Mazda or Tungsten	Clear	Dark	Dark	3.4

The meaning of this table is that if the ceiling and walls are both light the number of foot-candles in the above, that is 4,000, is divided by the constant 5, giving 800 watts required. If the ceiling is light and the walls dark, the 4,000 foot-candles are divided by 4, giving 1,000 watts required. If both ceiling and walls are dark, the constant is 3.4 and the 4,000 would have to be divided by this number to give the number of watts of energy required to illuminate the hat store under these conditions.

The next item to be considered in such an installation is the proper reflector to use. This company specify four reflectors for this type of work, viz.: the concentrator, the focusing type, the intensive type and the extensive type. These are illustrated herewith. To make a choice as to which of these four reflectors to use the procedure is as follows: Suppose the calculations already made have resulted in showing that 800 watts of energy is required for this particular room. This may be supplied in a variety of ways, for example, by two-400 watt lamps, four-200 watt lamps, eight-100 watt lamps, etc. The particular lamp to be used will be regulated by the outlets, fixtures, decorative conditions, preference of the customer, etc. The number of lamps having been settled, also their distance apart and their height from the floor, use is now made of the curves shown in Fig. 1. In this figure the horizontal numbers represent distances between outlets in feet; vertical numbers represent the height of the reflector. Suppose for example in this particular installation that the units are to be spaced 12 feet apart and 14 feet high. From the number 12 on the horizontal line follow the perpendicular upward until you touch the cross line representing the height above the floor at which you have decided the lamp shall hang, 14 feet. This will always bring you between two consecutive lines of the four shown in this chart and the one to the left of this intersection point indicates the type of reflector you must use to get the best results. In this case the line to the left is marked the "focusing" type. This indicates that the type of reflector shown above as the focusing type of reflector will give the best illumination results under our supposed conditions.

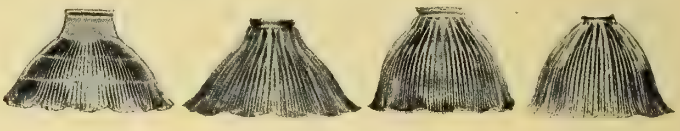

Concentrating Focusing Intensive Extensive

Fig. 2.

Handsome Scientific Books

D. T. McAinsh & Company, publishers, 123 Bay street, Toronto, are clearing out a number of handsomely bound scientific books which cover many interesting phases of modern electric practice. In the lists are included "A Dictionary of Electrical Engineering," edited by H. M. Hobart, M.I.C.E., M.I.E.E., M.A.I.E.E., in two volumes, imperial 8 vo., Roxburgh binding; "Science in Modern Life," edited by J. R. Ainsworth Davis, M.A., F.C.P., in six super-royal octavo volumes; "Modern Electric Practice," edited by Magnus Maclean, M.A., D.Sc., in six super-royal octavo volumes; "Technological and Scientific Dictionary," edited by G. F. Goodchild, M.A., B.Sc., and C. F. Tweney, one volume, super-royal octavo Roxburgh binding; "Modern Power Generators," edited by J. W. French, B.Sc., two volumes, super-royal quarto, cloth binding; "Machine Tools," edited by J. W. French, B.Sc., two columes, super-royal quarto, cloth binding.

Mr. E. H. Fitzhugh has resigned the presidency of the Montreal and Southern Counties Railway Company, and is succeeded by Mr. William Wainwright. Mr. W. B. Powell will continue to act as vice-president and general manager.

The Dealer and Contractor

The Mutual Relations of the Electrical Jobber, Dealer and Contractor

By Mr. F. N. Averill*

Some contractors and dealers and some jobbers are quite likely not to agree with me in many of the statements which I may make here, and to them I wish to say that this paper is not intended to be an expression of other than my personal ideas. Some of these ideas are not practical to-day, but I sincerely trust that the time is near when they can be put into operation, by the firm which I represent, at least. Any criticisms offered are not intended as personal criticisms, but are criticisms of jobbers and contractors as a body.

Before I can get to the subject of the relations between jobbers and contractors it appears necessary, to my mind, to define what I think a jobber should be and what I think a contractor should be. It is quite generally granted that the jobber is the economic outlet for the manufacturer in marketing his products, as he acts in every trade centre either as a distributing agent or a direct representative of not only one manufacturer, but of many, and as a result can market their goods from one place of business with one sales organization at considerably less expense than the various manufacturers if they tried to market their goods direct, or if several of them should combine and work under one management. Further than this, the manufacturer has his accounts receivable in a comparatively few number of book accounts, and these few accounts are practically all safe ones. This explanation is one big reason why practically all manufacturers recognize and protect the jobber.

From the contractor's standpoint, one reason for the existence of the jobber is that the jobber gathers from the four corners of the country into one place of business the various lines of supply items used by the contractor in his work, and thus enables the contractor to secure from one source of supply practically everything he needs for the carrying on of his business. This stock enables the contractor many times to economize in his work, as he can go to the jobber's place of business and perhaps see what is to him a new line of fittings suitable for a certain piece of work, which line of fittings, perhaps, are much better adapted, cause a saving of labor and possibly are a cheaper line than the contractor originally had intended to use. Besides, the jobber can often suggest a certain line of material for a certain piece of work, due to his broader experience with the different lines on the market, where, if the contractor had to depend on purchasing from the manufacturer, he would not have the chance of changing his requirements. Very often a local jobber can and should be willing, and generally is, to post the contractor on any line of new stuff that is coming on the market, stands between the contractor and the manufacturer as to the quality of the goods, guarantees to the contractor that such items as he selects for a certain piece of work will be approved by his inspectors, or in case the article furnished is not suitable for the purpose and the inspectors turn it down, your local jobber is always ready to stand back of you and see that you get the right article for the work. In some instances, especially for slow moving merchandise, you pay the jobber more money than you would if you shipped your requirements direct, but in the majority of instances you pay the jobber considerably less money than if you pick up your hundred and one requirements from as many different sources of supply, and in the aggregate your costs are less.

On top of this, the jobber stands ready to assist you by enlarging your line of credit to a certain extent when you get up against delayed contracts, and when you lay before him in a straightforward manner the conditions which necessitate your asking for this extension of credit. This feature of the business is greatly abused by both sides; that is, the jobber and the contractor are both to blame. The jobber is to blame in that he is not strict enough with you, due to the fact that he is afraid if he is not lenient that he will lose your business and some one of his competitors will get it. Some of you take advantage of this fact and will make it a point to pay all other creditors, perhaps take a summer vacation, and allow your jobber, because he is a good fellow, to wait. This condition of affairs, instead of breeding confidence, breeds distrust and generally works out like loaning money to a friend, as after the money is loaned, you have lost your friend.

Jobber Should Not Compete

The jobber has recognized the fact that the manufacturer needed him as an outlet for his product, has also recognized the fact that the contractor needed him, and as a result we not only have one or two jobbers in every trade centre for this purpose, but in some cases we have nearly as many jobbers as there are contractors. As a result of the conditions which brought about the establishment of the jobber, I personally believe he is not entitled to, nor can he afford to take away the legitimate earnings of the contractor and dealer by entering into any lines of electrical business other than a purely jobbing or wholesale business and that these conditions do not make it right that he compete, directly or indirectly, with the contractor and dealer, either in the contracting or retail business. I have more respect for the jobber who comes out in the open, saying that he is operating a retail store and who retails his goods at retail prices and makes no bones of being a competitor of yours than I have for the jobber who side-steps the retail issue, but who is, under cover, selling his goods retail at wholesale prices. The day has passed not so very long ago when jobbers made a practice of operating a contracting business along with their legitimate line and I feel that the time is passing when a jobber should operate any branch of his business to compete with the customers who make his existence possible. The opinion is quite agreed that the jobber is entitled to look for his outlet to the contractor and dealer, to the central station, isolated plant, municipal, State and National government, railroad, telegraph and telephone systems and the large industrial corporations, as it is quite apparent to anyone in the business that the demands of these buyers are such that no one other than a jobber can handle them in a successful manner as to service.

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*Read at Portland Convention of Electrical Contractors Association.

In carrying out my ideas of a jobber, he could as well be located in a warehouse or suburban location as in the heart of the city, as he would have nothing whatever to show the public, no show window displays, retail department or loafing rooms. At this time it would take a firm of strong courage and a well filled purse to put into effect all the ideas which I believe constitute a true jobber, unless all jobbers would get a change of mind at the same time.

As to the contractor and dealer, I believe the time is fast coming when the retail business will be taken care of by an electrical dealer operating a neat, well appointed store on some principal retail street, in which he makes suitable displays and demonstrations of the varied lines of electrical supply items and such electrical apparatus as appeals to the shopping trade. He will do practically no contracting, but will confine himself strictly to the retailing of such items as he carries and will do only such installation work as forms a part of his sales, together with a small repair department for minor work that would come to him. He will leave the competitive bidding, the new work and the troubles of the general contracting business strictly to the electrical contractor, who will conduct his business from an office building, with perhaps a storeroom at some point in the city where he obtains cheap rent. Thus will come about the segregation of this business—first, the manufacturer; second, the jobber; third, the contractor, and, fourth, the dealer and retailer.

Dealer and Contractor Identical

As it is to-day the words contractor and dealer mean practically the same thing. The majority of contractors are dealers, to a certain extent, and, so far as I know, all dealers are contractors. So in speaking of the relationship between the jobber and contractor I include the dealer in the same class with the contractor.

The dealer of to-day and the dealer that we will have with us to-morrow, of necessity, have to carry a certain assortment of stock, and on staple items do, and will always buy in quantities sufficient to get them the best price obtainable from the jobber. With them this is quite necessary, as competition at the present stage of the game, not only with themselves, but with many of the jobbers, is very keen, and as they have a very much higher overhead expense to stand than the true contractor who operates from an office. To play a safe game, the true contractor should confine his purchases to exactly what he needs for certain jobs, excepting, of course, that it is policy to combine the purchases for a job ready to-day with the requirements of a job which you actually have ready for to-morrow. In buying your requirements for actual work on hand you many times will pay more for your purchases than will the dealer who buys in large quantities, and you may think that this condition gives this dealer who is at present doing contracting work an advantage over you, but such is not the case, as the dealer has additional overhead charges to meet which more than offset the difference in quantity price, and, furthermore, when he takes an inventory, he has a large portion of his assets tied up in merchandise, while the true contractor has his assets in accounts receivable or uncompleted contracts. I believe that the time is fast approaching when this segregation of the dealer and contractor will be recognized by the majority as the most economic manner of conducting this business.

The one great trouble with the contractor, next to the lack of capital in starting his business, has been this tying up of money (either his or his creditors) in stocks of goods which, on account of changes in the code or changes in demand, have become practically worthless, and, as a result, the contractor has been carrying them along on his books as an asset, fooling himself and fooling his creditors. Accounts receivable certainly shrink fast enough in case of liquidation, but stock on the shelves shrinks many times faster.

Support the Jobber

When the time comes that such retail stores as I have mentioned are established, then the time is ripe for the jobber to withdraw into the wholesale district or suburban district and get out of the location of high rents, which at this time is one of his principal bug-bears. Under such conditions I cannot conceive of any valid reason why both the contractor and the dealer should not give their entire support to their local jobber, as he would become virtually their warehouse and would perform a service for them, and does to-day, for that matter, that is certainly commensurate with the returns which he gets. A better support by the contractor and dealer to the jobber in his own centre enables that jobber to get together a better stock and thus becomes of more value to the contractor or dealer. A lack of this support in the past has been the cause of considerable friction and has resulted in some jobbers being competitors of contractors and dealers and has caused some dealers to compete with the jobber. This competition by the dealer with the jobber has been made possible by cheaper lines of electrical merchandise and supplies which have been on the market, but primarily by the fact that the dealer would buy in maximum quantities and then job out goods so purchased in small quantities at prices less than the jobber saw fit to handle them. To my notion, the dealer who does this is making a mistake, as the jobber who maintains his prices based on quantities delivered at one time gives the best possible protection under present conditions to the retailer.

If the time comes when all jobbers can be wholesalers in the true sense of the word and not be tempted by the retail business, it will then be possible for them to market the goods which they carry to you at two prices only, that is, an unbroken standard package and a broken package. If such a schedule were put in to-day by all the jobbers located in the business sections of their various cities it would mean that the retailer would be out of business and the jobber would lose money, as his expenses would then be the equivalent of the retail business.

It may possibly be that I am entirely wrong as to what is forthcoming in the jobbing, contracting and dealer's business, as there seems to be a very strong movement on foot to-day to absolutely dominate the electrical business from its point of manufacture until it passes into the customer's hands. The only link that is lacking in this chain is the contractor's link, as this chain now has in its make-up the manufacturer, the jobber and dealer and the central station.

Coming back to the relations between jobbers and contractors. I believe that their business relations should be mutually enjoyable, that there should be a personality in the relationship, that there is more to the business than buying and selling, and that the jobber and contractor should strive to gain mutual confidence one in the other. Be broad enough minded to not feel hurt when your jobber asks you for money. This request is not intended as a personal insult, but, like you, he needs money to run his business and there is nowhere else that he can look for it except from whom it is due.

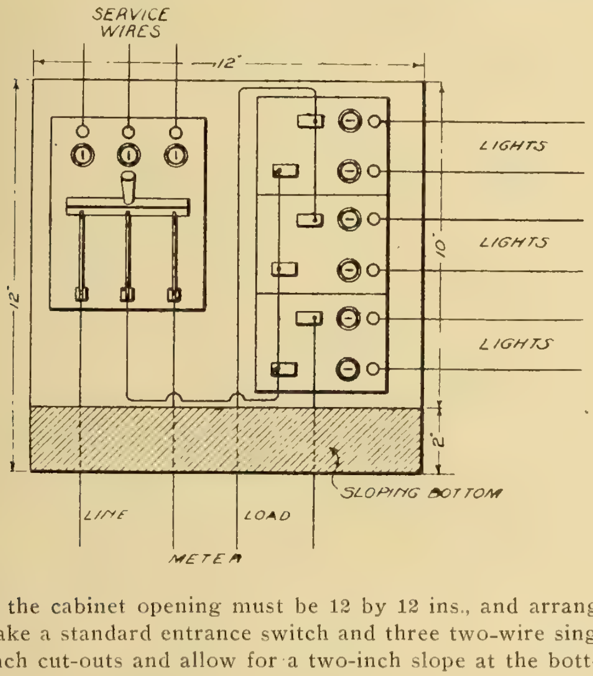
In closing, I wish to say I have faith in my business when properly conducted. I have faith in your business when properly conducted. I have faith in the policy which I have to-day outlined to you and my efforts in carrying out this policy, in so far as my company is concerned, will be evidence to you as to how sincere my faith is.

Cut-Out Cabinets

The Electrical Review prints the following interesting article by Mr. R. H. Eddy on the subject of "Cut-out Cabinets," having special reference to house wiring of the smaller class.

In the usual course of knob-and-tube wiring the cut-out cabinet is built into the wall of the house which is being wired by putting in headers between studdings, furring up the openings, and then lining with asbestos. This arrangement leaves any and all sizes of openings to be incased and covered with doors. Each wireman builds his cabinet to suit his own fancy, as a rule, and usually forgets to keep a record of the dimensions of the opening for which the door is to be made, or, if he does keep such a record, he is quite liable to forget to turn it in at the proper time. Then when the job is ready for the finishing touches—in the town where the writer works no lights are allowed to be turned on until the work is finished—another workman is sent out, who, after completing everything but the cabinet door and trim, takes the measurements for the door and brings or sends them to the shop. The shop orders the special door needed from the mill or from some carpenter, and finally has to have a man make an extra trip to the building to install it. Thus this lack of standard practice in the matter of such cabinets is almost sure to result in what is really an unnecessary loss of time and money.

In order to avoid such unnecessary loss, the workmen whom the writer employs are instructed to follow certain dimensions which are considered standard in our shop. Consider, for example, a house having eight rooms, and in which fewer than 36 lamps are to be installed. Our rule is that the cabinet opening must be 12 by 12 ins., and arranged to take a standard entrance switch and three two-wire single-branch cut-outs and allow for a two-inch slope at the bottom of the cabinet, there being left a working space 12 by 10 ins. on the back surface.



The next three sizes for cabinets are 12 by 15, 12 by 18, and 12 by 24 ins., respectively, the dimension given being intended to be applied to cased openings. It will be noted that the dimension 12 ins. is retained throughout; this is necessary because carpenters do not always allow 14 ins. between studdings.

By following this system, we find it convenient to order cabinet doors and trim by the hundred, and to get them for about half the price they formerly cost us.

This matter of following systematic plans in the installation of cut-out cabinets is something the electrical contractor can ill afford to neglect. A properly installed cabinet, with neat door and trim, and with the wires running directly out from the connections, and the contractor's name plate on the door is a standing advertisement for future business.

It is highly desirable that cabinets be built in the shop, and there lined, fitted, and connected up with three service wires, each slightly more than eight feet long coming out at the top, and a meter loop at bottom. When delivered to the workman on the job in this shape, the cabinet can be installed without loss of time. Building cabinets in the shop prevents waste of material, saves time and insures a better grade of work than it is reasonable to expect when they are built at the house where they are to be used.

In the accompanying figure the arrangement of cabinet and cut-outs which the writer prefers is indicated. The panel door is 12.5 by 12.5 ins., forming a half-inch rabbet with the casing, against the ground strips and plaster. The cabinet is 3 ins., deep in the clear. For casing, 4 ins. is allowed, and there is 1 in. clearance for the wires. Meter wires should be 18 to 24 ins. long. If neutral wire is required for the meter, it should be looped under the central contact on the service switch and then dropped through bottom to the meter outlet.

Lion-M Tungstens

Mr. John B. Neale, Electrical Products Company of Canada, has just renewed his contract with Messrs. Mix & Genest, of Hamburg, Germany, manufacturers of the celebrated Lion-M tungsten lamps. Mr. Neale has the sole selling rights for these lamps in Canada, and has recently appointed Messrs. Miller and Miller, of Edmonton, as his agents for Edmonton and Calgary. He reports that since taking this agency they have secured some very good contracts, one being for the installation of lamps in the Y.M.C.A., Winnipeg. Mr. Neale has also appointed Messrs. C. T. Inman & Company, 157 James street south, Hamilton, as his agents for that city. Mr. Neale leaves shortly on a business trip to Germany.

Have Increased Capital

The Thompson Electric Company of Cleveland, Ohio, announce that they have increased their capital from $10,000 to $150,000, to provide for increased business. Mr. A. J. Thompson, president of the company, is well known to the trade, as is also Mr. Chas. E. Pope, secretary and treasurer of the company, who was formerly mechanical engineer with the National Malleable Castings Company of Cleveland. The company manufacture the Thompson automatic safety cut-out hangers for arc lamps and large tungsten units and clusters, and will shortly place on the market a high voltage series cut-out hanger for street lighting.

New Appleton Ground Clamp

A new ground clamp has been placed on the market by the Appleton Electric Company, 212 North Jefferson Street, Chicago. This has met a demand among electrical contractors for a clamp which can be more readily applied. The device is made in a single piece of sheet steel and designed to fit three-eighths-inch or one-half-inch conduit. The clamp is always very accessible and when put into a box it can be tightened to the gas pipe with an ordinary screwdriver.

The city of Lethbridge has engaged Mr. R. A. Ross, of Ross & Company, consulting engineers, Montreal, to investigate and report on the cost of producing electric power from (a) natural gas; (b) run-of-mine coal, and (c) slack coal.

Current News and Notes

Amqui, Que.

An electric lighting plant is contemplated.

Berlin, Ont.

Two new cars of the Preston type have just been placed in operation on the Berlin and Waterloo road. It has been decided to inaugurate the p.a.y.e system on this line, beginning April 1st.

Brandon, Man.

The city council awarded the contract for motor generators for the power plant in connection with the street railway system to the Canadian General Electric Company.

The Brandon Street Railway system will be further extended as far as the Dominion Experimental farm in the northwest part of the city.

The street car bodies for the new municipal railway system which are being manufactured by the Niles Manufacturing Company, of Iowa, will shortly be shipped to Winnipeg and equipped there with electric motors and accessories. These latter are being supplied by Canadian firms.

City Electrician Skead has planned a large electrical sign for Brandon, which will be used first during the Dominion Fair, but will be a permanent installation. Mr. Skead's suggestion is a circle 30 ft. in diameter with letters 18 in. in height. It is calculated that 1260 two-candle power lamps would be required and that the total cost would be about $2,000.

Mr. O. L| Boyd, late Winnipeg representative of the McDonald & Willson Company, has formed an electrical contracting company to be known as the Boyd Electric Company, Limited. This new company will operate in Brandon, Man., where Mr. Boyd believes there is a fine opening for electrical equipment.

Brechin, Ont.

The by-law to enter into a contract for the supply of Niagara power carried by a vote of 23 to 18.

Calgary, Alta.

Mr. R. A. Ross' report on the power situation is said to state that Calgary is receiving power from the Calgary Power Company at approximately as cheap a rate as it can be produced by burning gas under the furnaces. Calgary has talked of $10 power with the advent of cheap gas, but Mr. Ross does not think this is possible. The report suggests the insertion of rather stringent penalty clauses in the new agreement, in case of failure of the Calgary Power Company's lines. At the present time the Calgary Power Company's service is not as satisfactory as it might be, but it is believed that, with the duplicate plant in service, a continuity of supply can be guaranteed.

A decision has been reached to organize the nineteen sections lying just to the east of this city into a town municipality to be known as East Calgary for the purpose of raising money by debentures to bring in natural gas from Bow Island and build up a big industrial community. The population of this district is about 2,000, which is sufficient for the suggested purpose.

Cayuga, Ont.

By-law carried by ratepayers to take power from Hydro-electric Commission.

Dalhousie, N.B.

Tenders are called to March 5 for the supply of complete equipment for an electric light system for the town of Dalhousie, N.B. The engine capacity required will be 150 h.p. and the generator 100 h.p. Chipman & Power, civil engineers, Mail and Empire Building, Toronto, have charge of the installation.

Edmonton, Alta.

Telephone equipment estimates for 1913 include terminals and switches, $133,652; telephones and installations, $85,000; branches and materials for underground cables and aerial lines, $630,000.

Street railway estimates for 1913 include rolling stock, $350,800; permanent track work, $630,000; extensions, $144,000; special tracks, $106,200; sub-stations, $62,250; high level bridge, $62,000.

The commissioners have reported favorably on extensions to the street lighting system amounting in cost to some $186,000.

The street railway system of this city was operated for the year at loss of about $25,000. This is the result largely of running a number of lines into suburban districts for the purpose of increasing land values. It is hoped that by charging a straight 5c rate, and making only judicious and economical extensions in future, the system can be put on a paying basis without much delay.

The operations of the municipal power plant for the year show a profit of something over $13,000.

Estevan, Sask.

The felling is very optimistic that power will be obtained in the not distant future for this and other cities in Saskatchewan from the lignite coal fields to the south. It is said that a company has been organized with $2,500,000 capital to buy land and install producer-gas equipment for generating power.

Fingal, Ont.

The Fingal Telephone Company contemplates extending its lines into the Port Stanley district and will require equipment.

Fort Frances, Ont.

Telephone system—time extended for receiving tenders from February 1st to March 1st.

Fredericton, N.B.

Some additions are being made to the arc lighting street system. It is also suggested that the town should utilize an old generator already in its possession for applying the current to the street lights and for other municipal requirements.

Hamilton, Ont.

It is said the Hamilton Street Railway Company will build five or six miles of extensions, work to start in spring; new cars will be required later.

There is much opposition to, and apparently very little support of, a duplicate telephone system in this city.

Listowel, Ont.

Purchase of electric lighting equipment is contemplated.

London, Ont.

The city council will ask the legislature for power to take a vote on the question of electrifying the London & Port Stanley railway.

It is reported that double tracking will be done in several parts of the city, and that 80-lb. rails, frogs, etc., will be required.

Negotiations are said to be under way looking to an arrangement between the C. N. R. and the London & Port

Stanley Railway Board. The road may either be leasèd or sold to the company. Before any agreement can be ratified, however, the matter will be submitted to the ratepayers as an alternative to the scheme of electrification.

It is said plans are to be prepared and equipment purchased for developing 500 horse power at Springbank pumping station.

Macklin, Sask.

The town council is considering the erection of an electric light plant this year.

Medicine Hat, Alta.

A contract has been awarded by the government for the installation of an automatic telephone system in Medicine Hat.

Montreal, Que.

The Bell Telephone Company has made application to council to install underground wire in conduits on twenty streets.

It is reported that the Montreal Light, Heat & Power Company will soon issue some additional stock, rendered necessary by extraordinary expenditures, including a new gas plant at Cote St. Paul, estimated to cost two million dollars, and the addition to the head office building.

The Montreal offices of the Canadian General Electric Company, Limited, and the Canada Foundry Company, Limited, have been removed from 81 St. Peter street to 162 St. Antoine street west.

North Toronto, Ont.

The city's application to the Dominion Railway Board, asking that the Bell Telephone Company be directed to apply to North Toronto the same rates that prevail in the older portion of the city, came before the Board on Friday, February 7. The company conceded a reduction amounting to $20 a year. Judgment of the Board not yet announced.

Ottawa.

The city has applied to the Hydro-electric Power Commission of Ontario for an extra 1,000 h.p. of energy. The present contract calls for 4,000 h.p. and as the municipality is using well up to this amount, it has been deemed advisable to make application as above.

One-quarter of a mile of ornamental iron standards and five-light clusters for Sussex street is proposed, also transformers, meters and general electric equipment.

Assemblyman Patrie of the New York Legislature has introduced a bill to appropriate $282,000 to defray the expenses of a hydro-electric power development at two points in the state.

An interesting lecture was given before the Ottawa branch of the Canadian Society of Civil Engineers on Friday, February 7th, by Mr. A. A. Dion, manager of the Ottawa Electric Company, on Electrical Underground Conduit Construction.

Porcupine, Ont.

A novel use was recently made of electricity in connection with a strike in one of the mines when a number of wires were strung around an area where a number of strike breakers were operating. These wires were then charged (or said to be) with electricity, and signs to that effect and drawing attention to the danger of approaching were hung from the wires. It is said that there was no difficulty experienced in keeping the strikers from interfering with this mine.

Prince Albert

The city of Prince Albert has completed its first installation of 129 ornamental tungsten standards. Work commenced October 15, 1912, and the lights were turned on December 28th. The cable was supplied by the Canadian British Insulated Company, and the standards by the Union Metal Company. It is said to be the present intention to install 150 more of these standards during 1913.

Regina, Sask.

The heads of the different utilities are asking to be given full control of their departments, this to include all accounting and other work in connection with it, the same as if the utility were separately and privately owned. City Electrician E. W. Bull is head of the electric light department, and Superintendent Doughty of the street railway department. It is understood that this system will be adopted.

Reserve Mines, N.S.

It is said the Cape Breton Electric Company, Sydney, N.S., will install railway motors, add railway feeders, machine equipment, erect two-storey addition to present warehouse and freight shed, new telephone despatching system for Glace Bay, improvement to Sydney power station, switchboard, special railway work, etc. Manager, E. L. Milliken.

Rossland, B.C.

The annual report of the West Kootenay Power & Light Company for the year ending August 31, 1912, shows assets to the amount of $4,134,737. The gross receipts for the year were $332,864; operating expenses, including maintenance, repairs, etc., $110,257. The capital of the company is represented by $1,500,000 bonds, $300,000 in preferred shares and $2,000,000 in common stock. A dividend of 2½ per cent. was paid on the latter.

Saskatoon, Sask.

By-law was submitted on February 11 to raise $100,000 for extensions to street railway system.

On February 11, the electors voted on a by-law to raise $150,000 for the extension of the electric light and power system.

A committee will be appointed to go fully into the matter of development of hydro-electric power on the Saskatchewan River. This committee will be given power to engage whatever expert opinion is deemed necessary for a full and complete investigation and report.

St. Catharines, Ont.

The Hydro-electric Power Commission has made an offer of 2,000 h.p. to St. Catharines at a $14 rate.

St. Charles, Man.

An electric lighting plant is contemplated by the rural municipality of Assiniboia. Internal combustion plant favored.

St. John, N.B.

Opposition is being raised to the damming of the St. John River by the St. John River Hydro-electric Company on the ground that it will interfere with the salmon fishing industry by preventing the fish from passing up the river in the spring time to spawn, as is their usual custom. This company propose to dam the river about forty miles above Fredericton for power development purposes.

The proposed street railway extension to Kane's Corner with double tracking on Brussels street is still under discussion.

The Dominion Coal Company will install at their new coal docks at St. John, N.B., four vertical submerged tubular boilers built for 150 pounds working pressure by the International Engineering Works, Limited, manufacturers of Robb engines, boilers, etc.

St. Johns, N. F.

The Reid Newfoundland Company, St. Johns, Nfld., have recently purchased from the Westinghouse Electric &

Manufacturing Company, one double equipment of No.323-A motors and 200-D-2 type control.

St. Thomas, Ont.

The Dominion Railway Commission have granted to the St. Thomas Municipal Street Railway System a right to cross the M. C. R. tracks at William street. The city pays the cost of installing the diamond and the city and railway company share equally the maintenance of the switches.

Sudbury, Ont.

The Wahnapitae Power Company has increased its capital from $250,000 to $500,000.

Tilbury, Ont.

Steps are being taken in this place to obtain power from the Hydro-electric Power Commission of Ontario.

Toronto, Ont.

The gross revenue of the Toronto Railway Company for the year 1912 was $5,448,050 as against $4,851,541 in 1911. During the past year 135,786,573 passengers were carried as against 120,997,844 in the previous year. The city's share of the gross receipts totalled $942,049, an amount considerably in excess of the dividends paid on the total capital stock of the company. Ten years ago the gross earnings of the Toronto Railway Company were $1,834,908, exactly one-third of to-day's total.

On Commissioner of Works Harris' suggestion a traffic manager will be appointed for the civic lines. It is understood that the p.a.y.e. system will be installed on civic lines as quickly as possible.

A route map of the proposed municipal railway connecting Toronto and Port Perry has been drawn up and includes besides the towns of Markham and Stouffville a number of similar places such as Unionville, Hagerman, Milliken, Agincourt, Ellesmere, Green River, Greenwood, Brooklin, Locust Hill, Balsam, Ashburnham, Goodwood, Claremont, Altona, Ringwood and Uxbridge. The government was asked for a bonus of $6,500 per mile.

Tenders will be received by the Hydro-electric Power Commission of Ontario until March 17th for galvanized steel towers, special crossing towers, copper cable, aluminium cable, insulators, galvanized malleable iron clamps, galvanized pressed steel clamps.

A number of suburban districts have been mapped out in which street lights will be installed as soon as possible. These include the Swansea district, 50 lights; the Runnymeade district, 50 lights, and the Todmorden district, 82 lights.

A minority report has been filed by Mr. Petrie, a member of the Joint Committee of the New York State Legislature on the conservation and utilization of water power, which favors the adoption of a system in New York similar to that operated by the Hydro-electric Power Commission. Mr. Petrie's report states, among other things, that "the Ontario system tends to develop to the fullest extent the manufacturing and commercial industries of the province."

Vancouver, B. C.

During the month Mr. Justice Murphy rendered a decision in the action of the Burnaby municipality against the B. C. Electric Railway Company. This action dismissed the application of the municipal authorities who requested that the franchise of the company in Burnaby municipality be quashed and an injunction be issued restraining the company from operating tram lines in the district. The franchise agreement which was the subject of the action, was granted by the Municipal Council without reference to the electors, in 1909. Since that time the question as to the validity of the franchise has been constantly under discussion. The company now operate an interurban line through Burnaby, but this route is covered by a line operated under a Dominion charter. No action has yet been taken by the Burnaby authorities concerning the appeal from the decision.

Walkerton, Ont.

Ratepayers voted on by-law to extend electric lighting system and grant franchise for five years.

Welland, Ont.

A deputation from this place recently waited on the chairman of the Hydro-electric Power Commission of Ontario with reference to the supply of another 7,000 horse power of electric energy for this town. Thorold also is negotiating for about 2,000 h.p., and if St. Catharines joins the hydro scheme, this will bring the total added requirements in this section to 11,000 horse power.

This municipality has purchased the complete distribution system of the Ontario Power Company within the town limits of Welland, including a sub-station and all auxiliary equipment as well as the distribution throughout the town. This will form a nucleus to a municipal system to which additions will be made as business requirements demand. The contracts held by the Ontario Power Company are also taken over by the municipality. It is understood the rate of power to Welland will be $14.

It is said that requests in this district for additional power supplied from the Ontario Power Company, have been met with the statement that this company is not in a position to supply any additional power in the Welland peninsula.

Westboro, Ont.

A complete electric lighting system for this village is under discussion.

Winnipeg, Man.

Tenders are received until February 14 for one 9000 kw. transformer. Specifications at office of engineer.

Tenders are called for electrical machinery, equipment and tools required in connection with Kelvin and St. John's Technical High Schools.

A contract has been awarded to Head, Shannon & Head, 410 McArthur Building, for an extension to McPhillips street power sub-station to provide for extension of street lighting system.

Enlarging Municipal Plant

At the meeting of the Ottawa City Council on Monday, February 3rd. it was decided to apply to the Ontario Railway and Municipal Board for authority to issue debentures for $150,000 to provide for enlarging the plant of the municipal electric plant as well as enlarging the present building.

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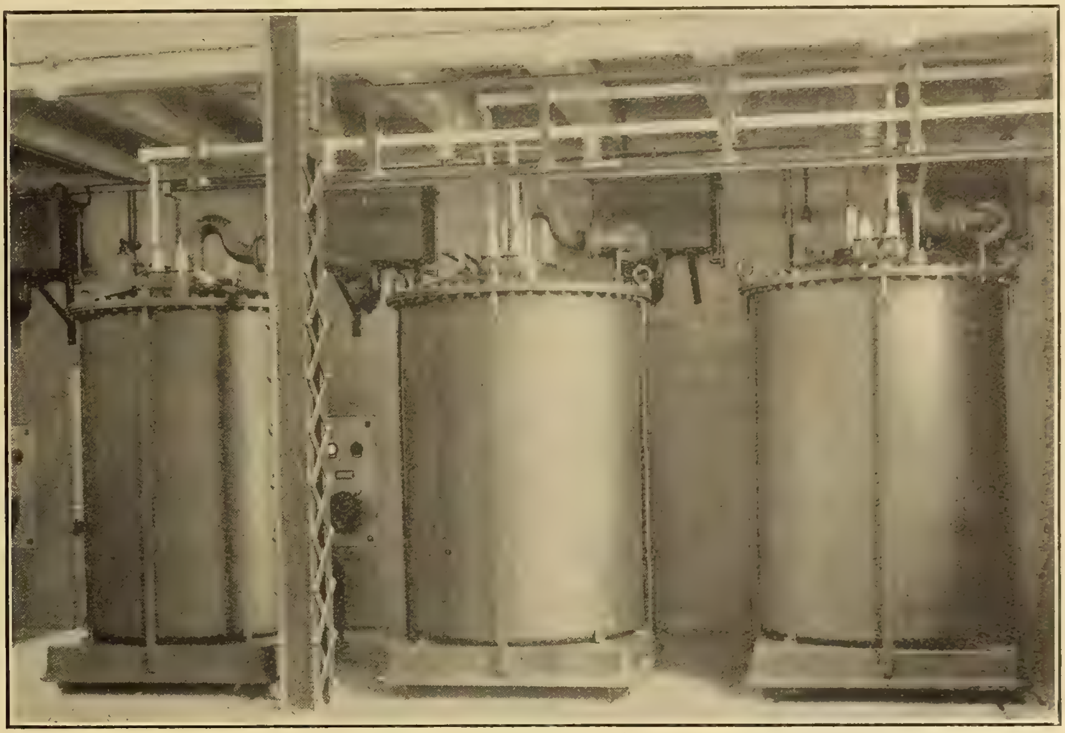

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Four of the above were a repeat order after the first bank had been in successful operation for eighteen months.

We also supplied the whole of the switching apparatus, lightning arresters and two 750 h.p. motor generator sets.

Attention is especially drawn to the expansion vessels connected by a pipe to the top of the transformer case. Our transformers are completely filled with oil including this connecting pipe, and part of the expansion vessel, expansion and contraction of the oil taking place in the latter.

By means of the peculiar shape of the connecting pipe the hot oil by the time it rises to the expansion vessel is sufficiently cool so that **no hot oil comes in contact with the air, and no moisture can enter the transformer itself.** This arrangement also keeps the oil in perfect condition and prolongs the life of the transformer.

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Position wanted by young electrical draughtsman with some experience in sub-station layout and operation. Good technical education. Best references. Apply Electrical, P. O. Box 2727, Winnipeg, Man. 3-4

Tenders for the Power-House Equipment

Sealed tenders registered and clearly marked on the outside of the envelope "Tenders for the Power House Equipment," and addressed to the City Commissioners, City of Regina, Sask., Canada, will be received up to noon, **March 15th**, 1913, for the supply of:—

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Six 500 h.p. water tube boilers complete with mechanical stokers and internal superheaters for 200 lb. pressure and 125 deg. Fahr, superheat.

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Two 133,000 cu. ft. per min. 3/4 or 7/8 housing, induced draught fans arranged to discharge through one vertical stack, 12 ft. in diameter and 70 ft. high above base of fans.

Price to be on equipment erected on foundation, built by the City of Regina, to contractors' requirements.

Copies of specifications may be had from E. W. Bull, Supt. of Light and Power, Regina.

A marked cheque covering five per cent. of the amount of bid, made payable to the City Treasurer, City of Regina, must accompany each tender.

The City Commissioners reserve the right to reject any or all tenders.

E. W. BULL,
4-5 Superintendent of Light & Power.

Situations Vacant

WANTED—First-class electrical salesman experienced in selling panel boards, switchboards, meters, transformers, etc. Splendid position for good man. Apply Box 695, Electrical News, Toronto, Ont. 3-4

First-class meter man, capable of repairing and calibrating house and power meters, also making motor tests. State experience and salary expected. Northern Ontario Light & Power Company, Ltd., Cobalt, Ont. 4-7

Sales Engineer

Sales Engineer:—Large Electric Manufacturing Company wishes to employ two young men in the Machinery Sales Department, college training and shop experience required, selling experience not necessary, but such experience will be given extra consideration. Apply Box 706, Electrical News, Toronto, Ont. 4-5

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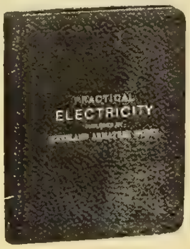

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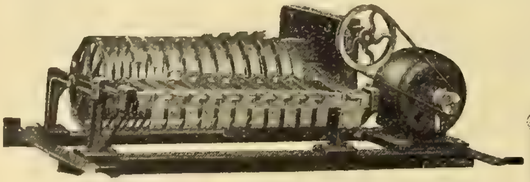

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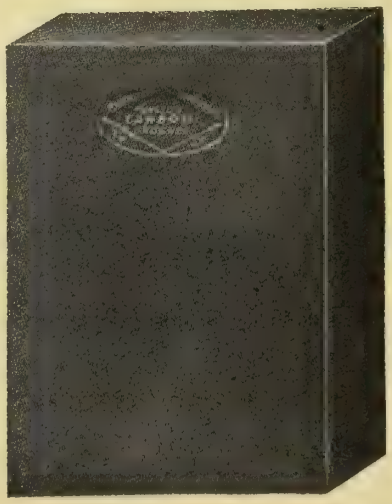

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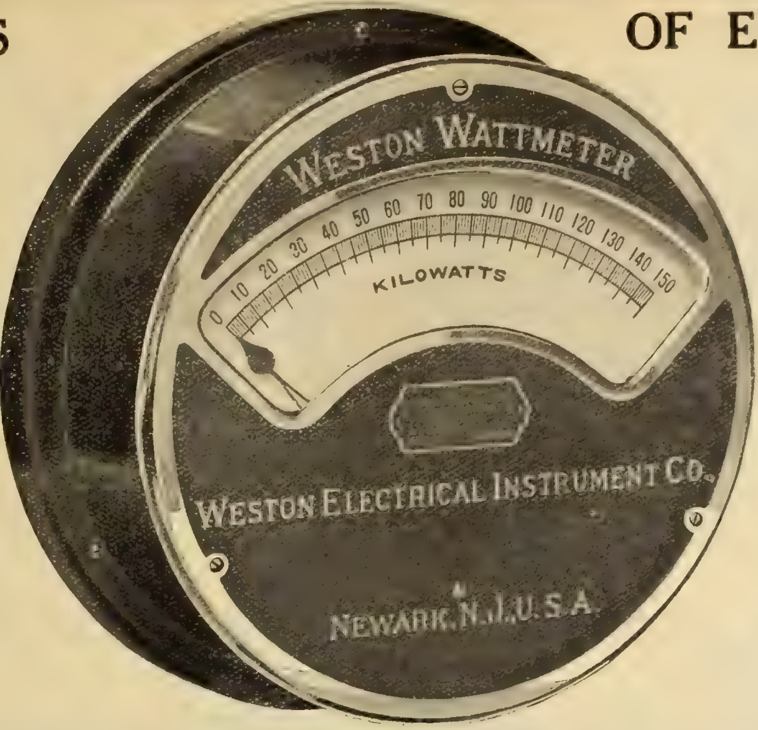

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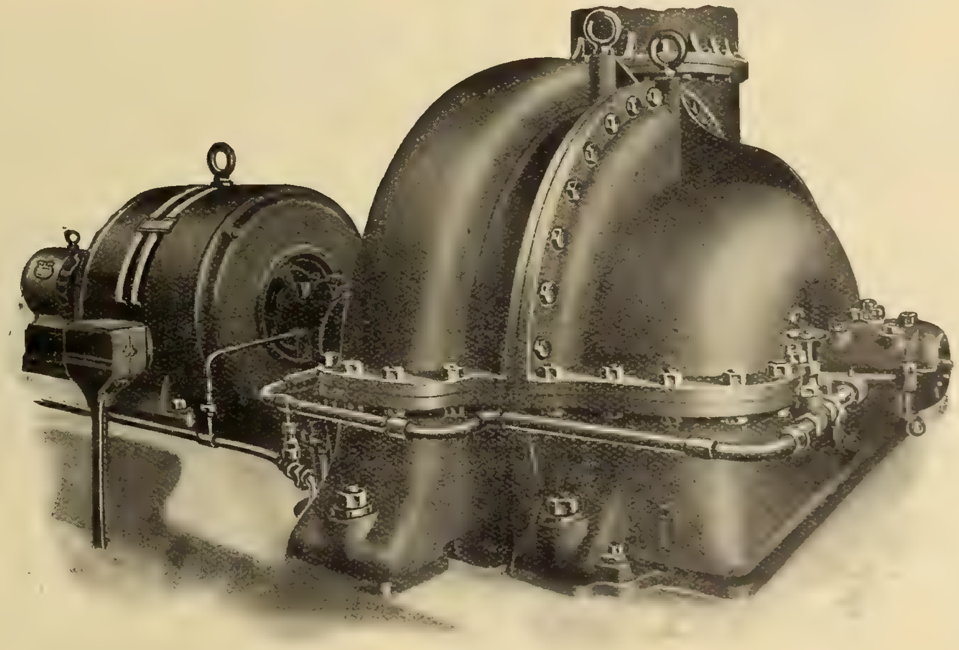

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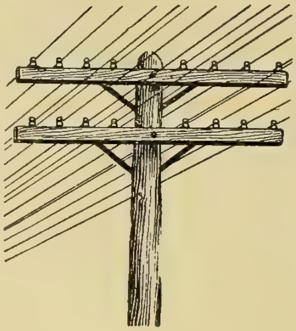

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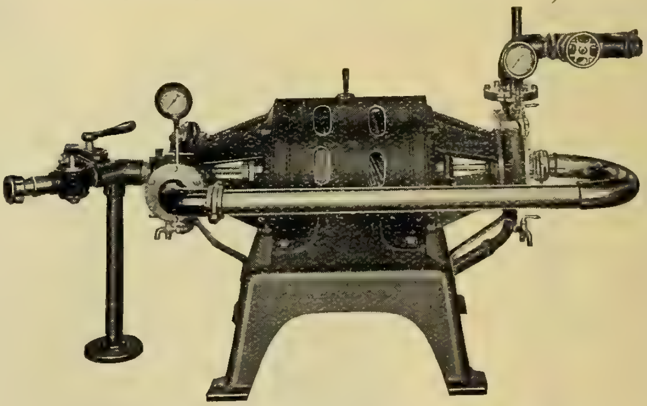

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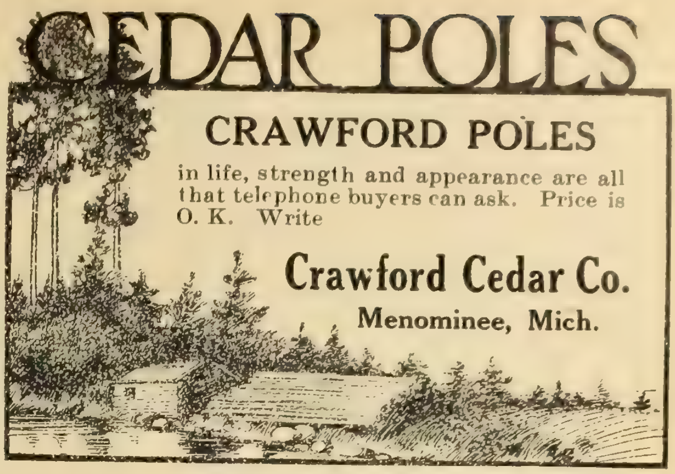

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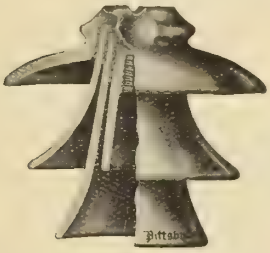

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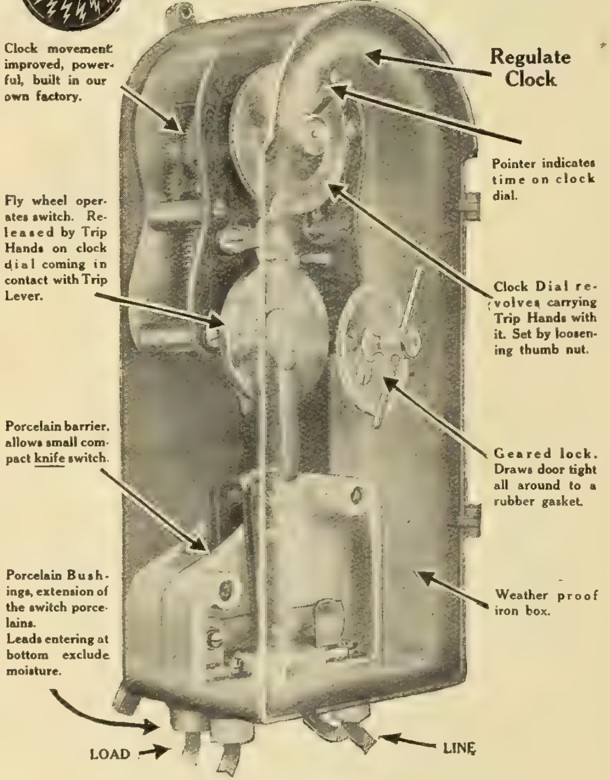
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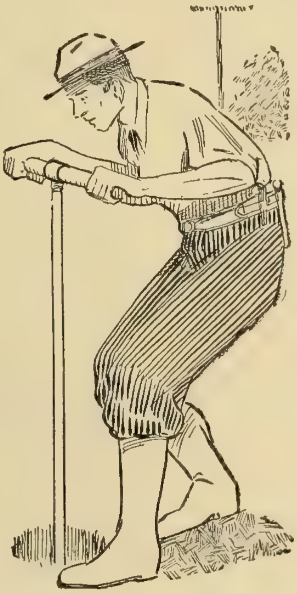

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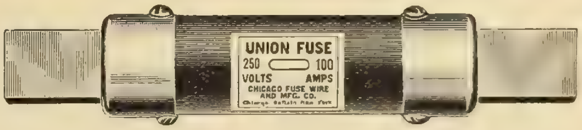

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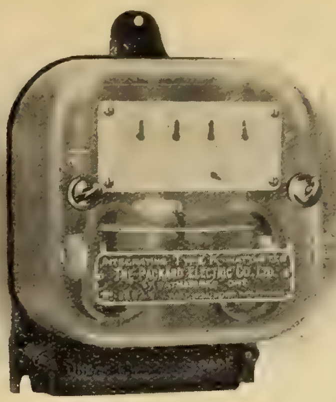

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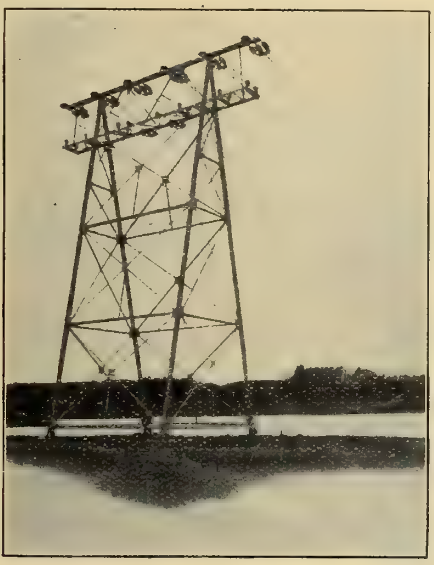

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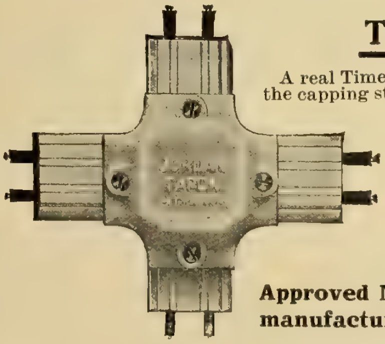

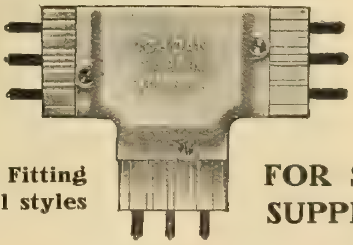

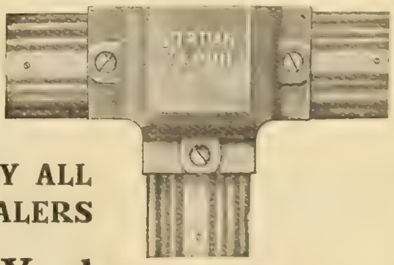

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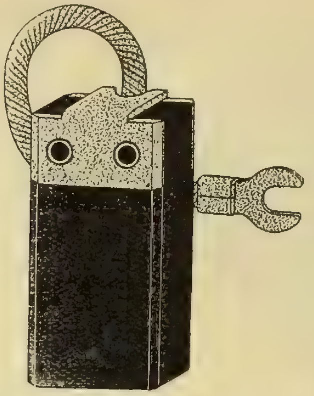

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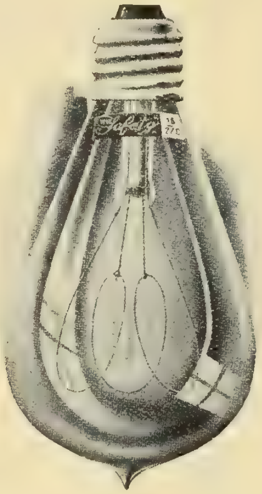

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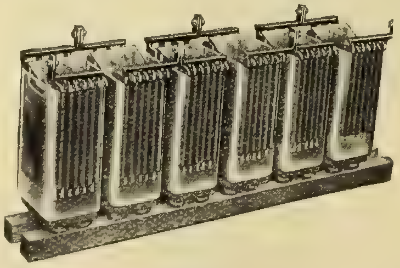

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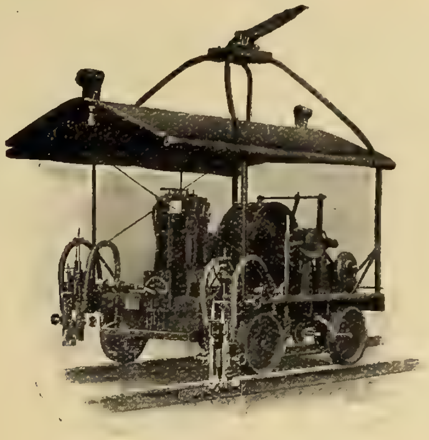

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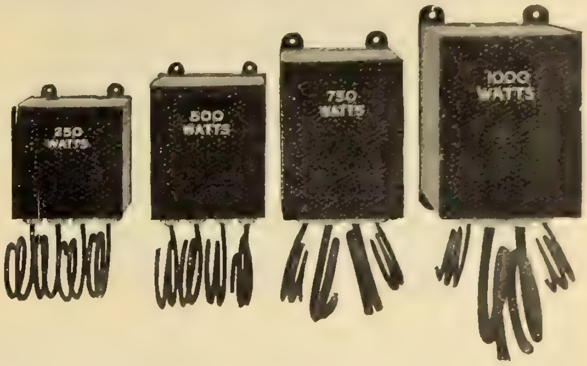

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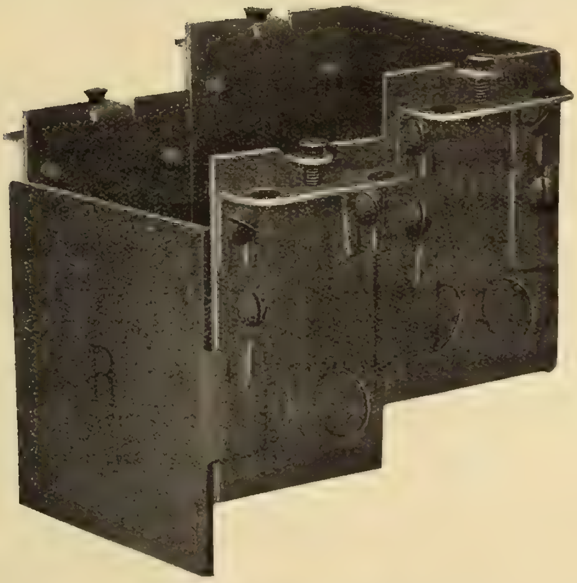

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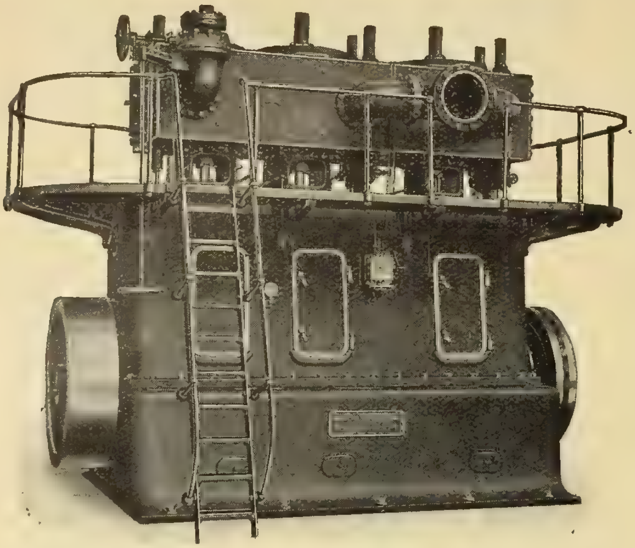

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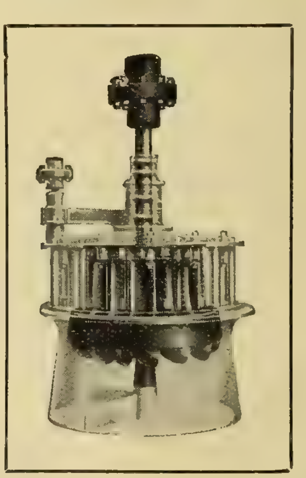

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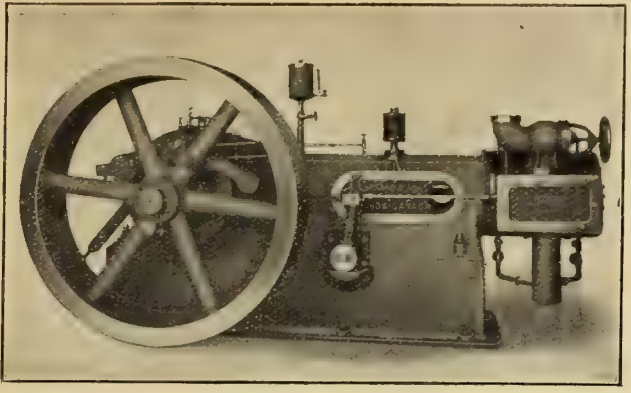

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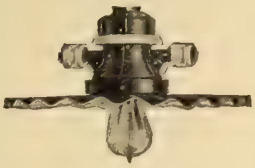

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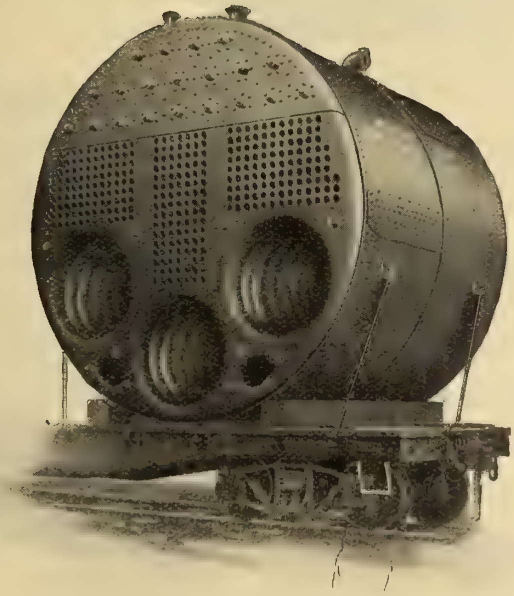
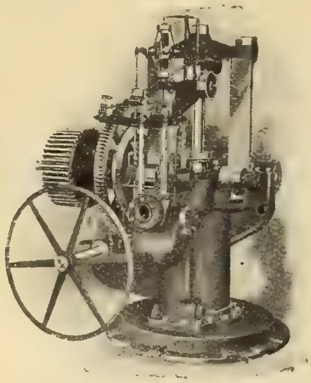


"Inglis" Boilers are the best by test. We make Return Tubular, Scotch Marine, Fitzgibbon, Scotch Dryback, Locomotive Vertical Submerged Tube.

We are also sole Canadian Manufacturers of Erie City Water Tube Boilers, Vertical and Horizontal.

Send us your enquiries

The John Inglis Company, Limited Engineers and Boiler makers
14 Strachan Avenue, TORONTO, CANADA


60,000 ft. lbs. capacity

WE MAKE

Water Wheel Governors in 25 standard designs. **Water Wheel Governors** of special design to meet special requirements. **Mechanically Operated Relief Valves** which are absolutely positive in action. **Governors** for large Steam Engines. **Governors** for Large Gas Engines, **Frequency Recorders** for switch-board gallery or office use. **Precision Tachometers** or Speed Indicators. **Long Distance Speed Indicators** for office use. **Speed Recorders.**

We Guarantee All of our roduct to be the Best rocurable, and will be glad to correspond with you in reference to any of it.

The Lombard Governor Co., Ashland, Mass.

"A"

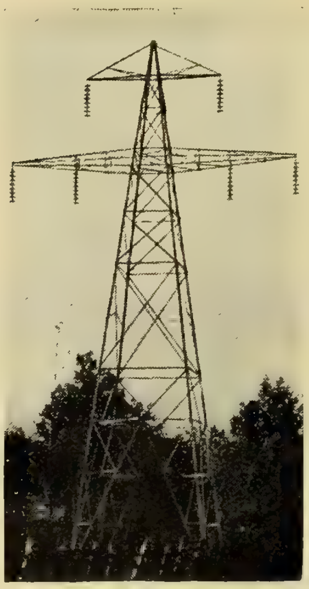
Splicing Compound

Made by pioneers of insulation engineering. "A" Splicing Compound is noted for its reliability and will be found excellent for rush jobs because it can always be relied upon.

Walpole Rubber Co., Ltd.
Montreal, Canada
Liquid and Rubber Insulation

American Co.: Massachusetts Chemical Co.
Walpole, Mass.
Pioneers in Insulation Engineering

TRANSMISSION TOWERS


DOUBLE CIRCUIT TOWER
One of 3,300 Towers furnished for the 300 mile Transmission Line of the Hydro Electric Power Commission of Ontario Transmitting a 110,000 volt current from NIAGARA FALL to the principal cities of ONTARIO.
The largest single order of Transmission Towers ever placed

Hot Galvanized or Painted

Estimates furnished on application

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Limited

Walkerville, Ontario, Canada

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STEEL RAILWAY AND HIGHWAY BRIDGES

Structural Steel of all kinds

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TRADE MARK

Canadian Billings & Spencer

Limited

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WELLAND, ONT.

Send us blue prints or models for estimates.

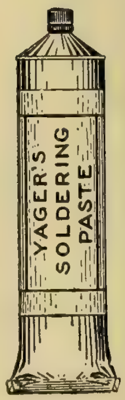
Yager's Soldering Fluxes

4 Forms—1 Result—A Perfect Joint

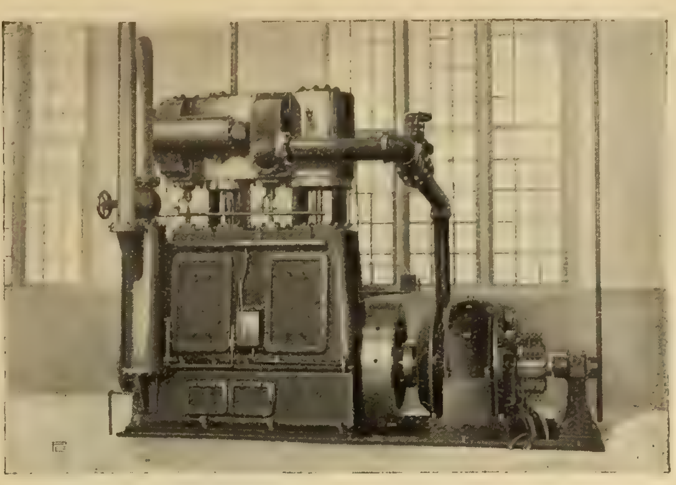
We don't ask you to take our word for it that **YAGER'S** Fluxes are the best—we want you to give them your severest test **AT OUR EXPENSE** and prove it for yourself. Send to us for samples of the kind you want, with your dealer's name and address and make your own tests.

Yager's Salts have been improved and kept up-to-date. Yager's **Stick, Paste,** and **Fluids,** are New Forms on the Yager's Salts base for greater convenience.

Write Now for Sample and Discounts to the Trade



ALEX. R. BENSON COMPANY
HUDSON, N. Y.



Vertical High Speed
Steam Engines

Especially designed for Direct Connection to Electric Generators.

Economical in Upkeep and in Floor Space required.

Illustration shows one of our Vertical High Speed Steam Engines recently installed.

This Engine is 150 H. P. Direct Connected to 100 K.W. Generator.

When Building or Remodelling your Power Plant, be sure to get our Catalogues and Prices on Engines, Boilers, etc. **G. & McC.** Equipment means **STEADY SERVICE ALL THE TIME.**

The Goldie & McCulloch Company, Limited

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"The Recognized Authority on Wiring and Construction"

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Over 267,000 Sold

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Member American Institute of Electrical Engineers; formerly Electrical Inspector for Boston Board of Fire Underwriters and Underwriters' Tariff Association of New York.

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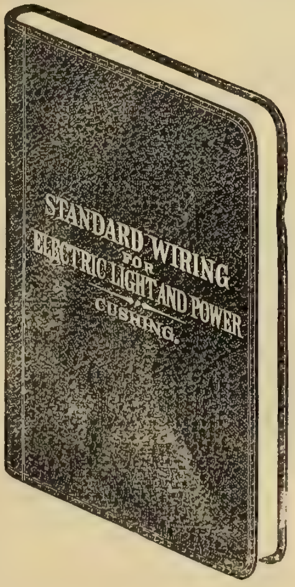

1913 Standard Wiring

is the only book on Electric Light and Power Wiring and Construction endorsed an recommended by every Board of Fire Underwriters in the United States and Canada, because it is the only one kept strictly up-to-date and revised every year in accordance with every rule and requirement of the

National Electrical Code

which it contains, explained and illustrated. The 1912 Edition has been completely revised from the first to the last page, and contains new illustrations, tables and diagrams in accordance with the latest and best practice.

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Sent to any address, postpaid, on receipt of $1.00 Leather Cover Pocket Size

Electrical News, 220 King Street West Toronto, Canada

"The Best Book on Wiring Ever Produced"—E. T. BIRDSALL, M.E., A.I.E.E.

Highest Efficiency

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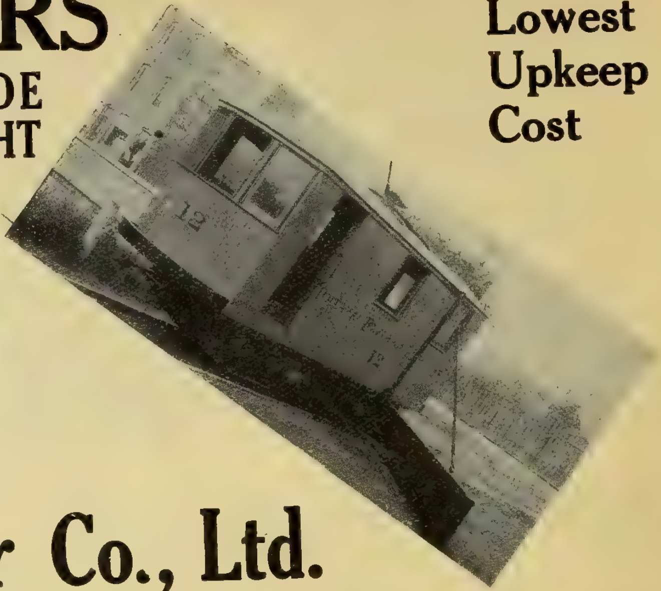
MADE RIGHT

Lowest Upkeep Cost



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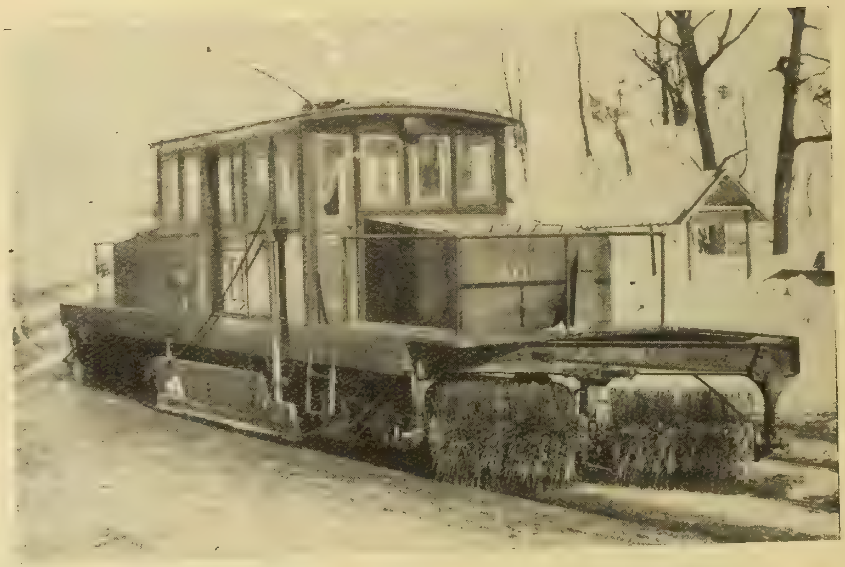
Ottawa Car Co., Ltd.

are Designers and Builders of

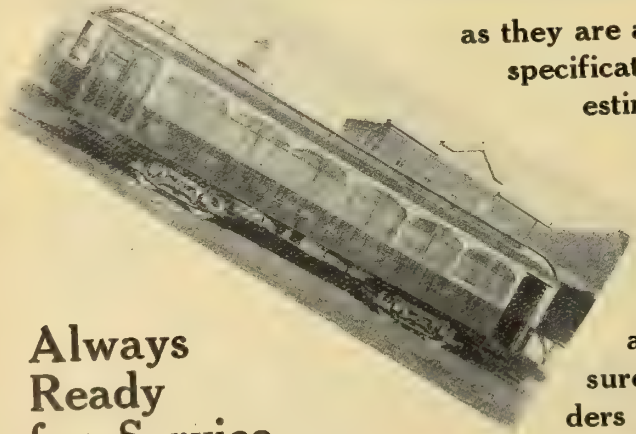
Electric City and Interurban passenger cars. Electric express cars and locomotives. Sprinklers and work cars. Car seats, car curtains and a very large variety of brass and bronze car fittings.

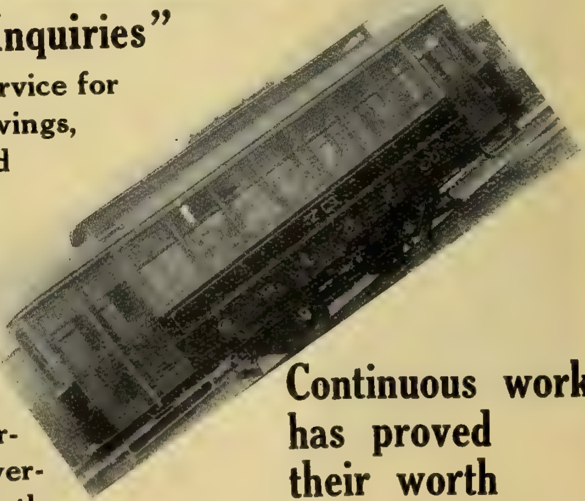


Snow Sweepers and Plows—the most perfect design and construction simple mechanism—quick and effective operation. An immediate delivery can be made of Standard Sweepers, special types designed and built or built to your own specifications.

"Send Them Your Inquiries"

as they are at your service for specifications, drawings, estimates and prices.





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Satisfaction assured on all orders and deliveries made promptly.

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1—20 h. p. 500 V. Westinghouse Electric Co.	Rebuilt
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1— 6 h. p. 500 V. 1600 R. P. M. Toronto Electric Motor	"
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At a few minutes notice we can supply the Celebrated Le Valley Vitae Carbon Brush in any size.

AND REMEMBER We have the Best Equipped Repair Dept. in the Province.

The Electrical Maintenance & Repairs Co., Ltd.

Long Distance Phones Adelaide 902-903 **162 Adelaide Street West, TORONTO**

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Does **your** plant stop operating when something goes wrong with the power transmission line? Don't be among the "thumb twirlers" when the juice is off.

A Waterous Boiler

A McEwen Automatic Engine

and an electric generator

in your own engine room, means cheap electric power and lots of it **all the time.**

Hundreds of isolated plant-owners in Canada will testify to this.

Send for our list of McEwen users and let us show you why.

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The Illuminating Glass

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MOONSTONE BALL GLOBE
FIVE SIZES

MOONSTONE--

The last step in diffusing glassware — Moonstone glass combines the qualities of all other glasses, ***then knocks the spots out of them.*** Moonstone is free from all spots, specks and imperfections and gives a perfect distribution of light.

Further particulars on application

The Jefferson Glass Company
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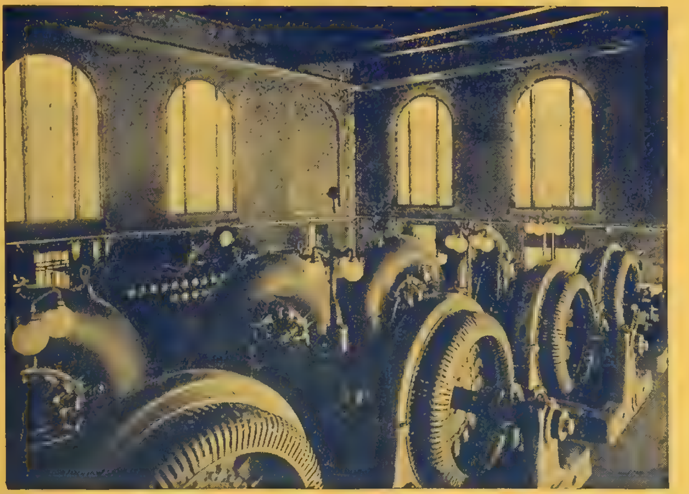
TORONTO CANADA

Vol. XXII—No. 5 Toronto, March 1, 1913

Electrical News

Generation, Transmission and Application of Electricity



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Francis Turbines

Power house of the Metropolitan Water and Sewerage Board, Clinton, Mass. (now owned by State of Massachusetts), where we have four hydraulic turbine units, each of 1600 Horse Power, under 100 ft. head, in constant operation. Turbines designed for heads from 5 feet to 600 feet.

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Use "EXIDE" BATTERIES for

Lighting — Ignition — Starting
Motor Boats and Automobiles

Reliable
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"Exide" Batteries embody the improvements of 23 years' experience in manufacturing Storage Batteries. All cells shipped charged, complete with full instructions.

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Head Office: TORONTO

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Electrical
Wires and Cables

Bare and Insulated Copper Wires and Cables.

Bare and Insulated Electric Wire and Cables for Aerial and Underground Use.

Railway Feeder and Trolley Wire.

Weatherproof Magnet and Rubber Covered Wires and Cables.

Incandescent and Flexible Cords.

Telephone, Telegraph, Lighting, Power and Street Railway Wires, Cables and Equipment.

Eugene F. Phillips Electrical
Works, Limited
MONTREAL - - CANADA

Branches: HALIFAX TORONTO WINNIPEG VANCOUVER

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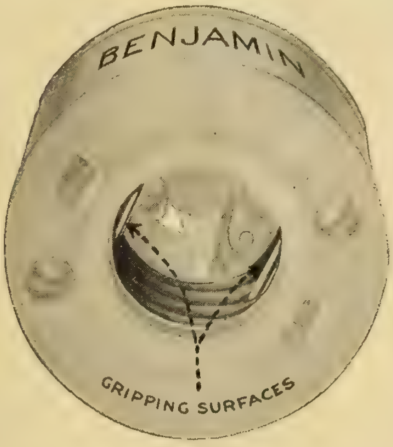
BENJAMIN LAMP GRIP

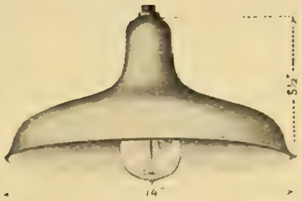
A Money Saving Device Costing You Nothing

supplied in all

BENJAMIN ADJUSTOLITES
BENJAMIN REFLECTOR SOCKETS

Flat Cone
Reflector Socket





Bowl Type
Reflector Socket

The Benjamin Lamp Grip is a device intended to forestall the loosening and falling of lamps. A simple spring means engages the lamp base with sufficient force to hold it in position. It thus prevents loss from breakage, saves the time necessary for re-adjusting, and renders accidents in dangerous quarters where the lamp might strike the workman, impossible. It is of particular value in the industrial field, places exposed to the wind, on steam cars, street cars, steamships, or wherever a lamp socket is subjected to excessive vibration.

Also supplied in many new devices listed in our new catalog C-21

Send in your name for a copy

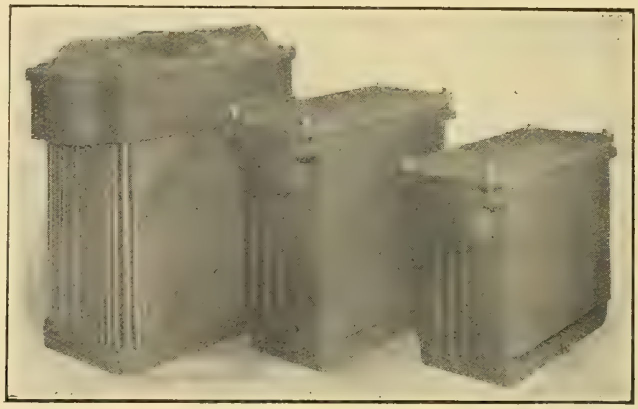
ALL ELECTRICAL JOBBERS CARRY A STOCK OF "BENJAMIN"

BENJAMIN ELECTRIC MANUFACTURING CO.

of Canada, Limited
11-17 Charlotte St., TORONTO, ONT.

FERRANTI

Transformers Meters



Three Phase Pole or Station Transformers

THREE phase pole oil immersed transformers have been proved the most satisfactory and efficient type. They effect a great saving in construction costs and reduce operating costs to a minimum.

In Ferranti high efficiency transformers all coils are wound with copper of ample sectional area, thereby reducing copper losses to a minimum. They are designed along simple and substantial lines and all parts are easily accessible.

In stock at Toronto and Winnipeg for prompt delivery at special prices—

100 to 300 Lamp Oil Switches
Motor Starters
Ammeters and Voltmeters
Portable Power Factor
Indicators &c.

Write us for particulars

Steel Case—Top or Bottom Connections

IF you are in the market for electric meters it will pay you to secure prices and particulars for Ferranti meters. They have many points of merit.

Simplicity of construction.
Perfect accuracy.
Cyclometer or clock dials.
Top or bottom connections.
Prompt deliveries.
Every meter carefully inspected before shipment.
Absolutely guaranteed.
Send us your probable meter requirements and let us make you a proposition.
Large stock and fully equipped repair and erection Shops at Toronto and Winnipeg.

The Ferranti Electrical Co. of Canada, Ltd.

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90 Sherbourne St.

WINNIPEG
56 Albert St.

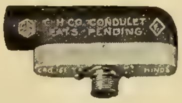
Common Sense Dictates Condulets

Because There's a Particular Type Exactly Suited to Each Conduit Outlet Requirement; Because They are Easily and Quickly Installed, Sightly, Strong and Lasting as Conduit—Also, There are Types for Which There are No Substitutes.

Just a Few to Suggest the Line

Type V C

Type A


Type E

Type X

Type L B

Type Q H C

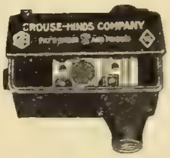
Type F S C

Type K D

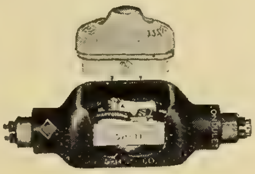
Type H A

Type N

Type S


Type Y S

Type P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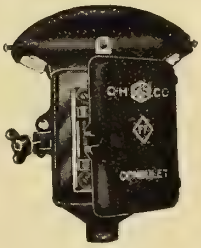
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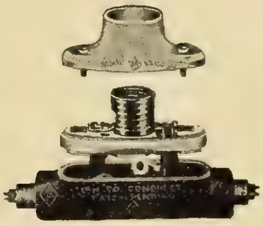
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Type W

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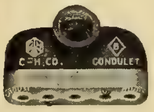
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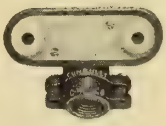
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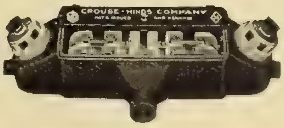
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Type R

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are made according to the specifications of the National Board of Fire Underwriters. The conductors are drawn from copper of the highest conductivity and are covered with two thicknesses of thoroughly vulcanized rubber compound of high quality. The wires are braided over insulation and the smooth high finish they receive makes them specially desirable for conduit work.

IMPERIAL WIRE & CABLE COMPANY
Limited
MONTREAL

THE Northern Electric
AND MANUFACTURING CO. LIMITED
SALES AGENTS

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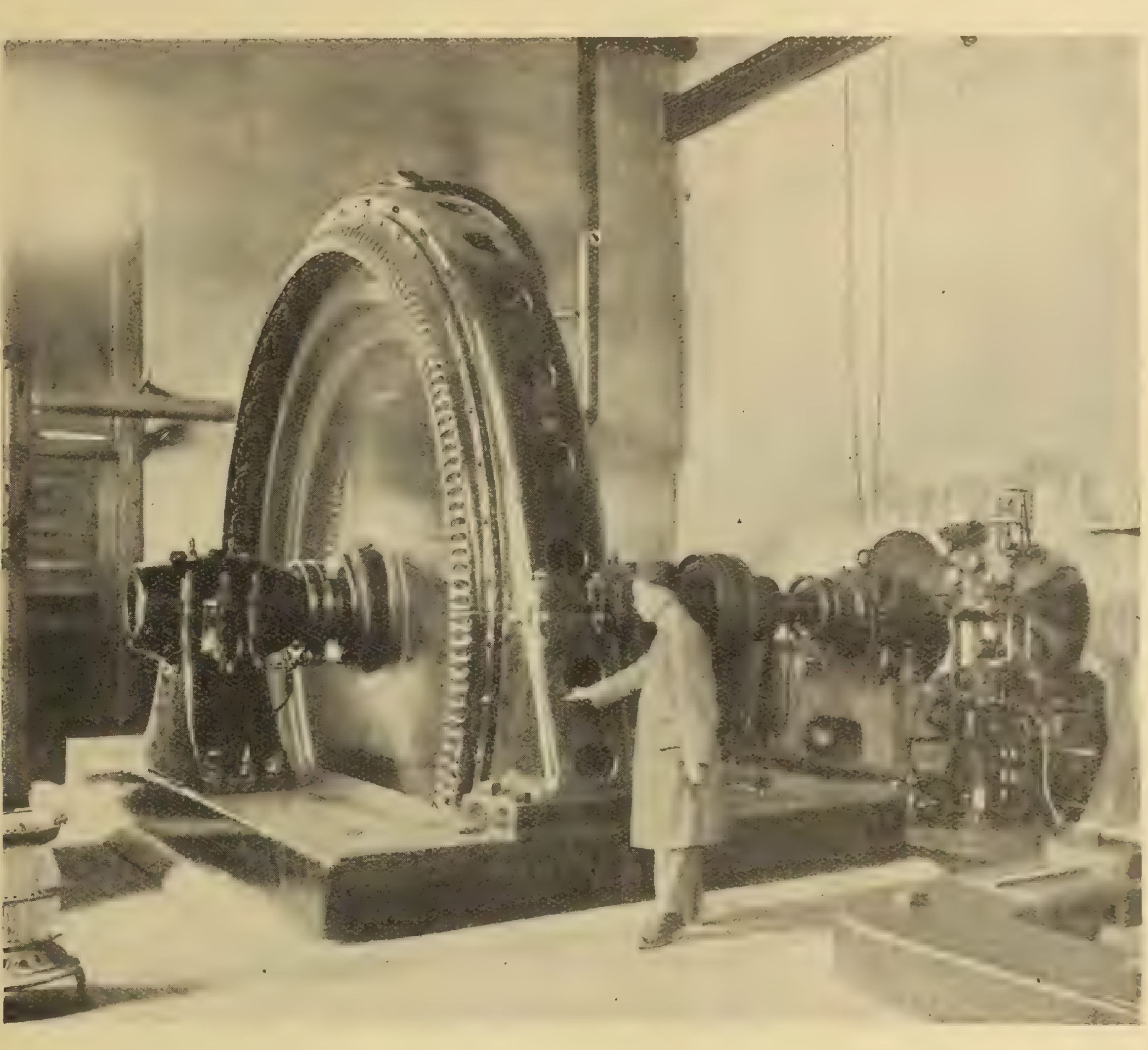
High Grade Electrical Apparatus



1,250 K.W., 120 r.p.m., 2,400 Volts, 3 Phase, 60 Cycle Water Wheel Type Generator installed 1910 for the Seymour Power and Electric Co., Campbellford, Ont.

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TORONTO

Branch Offices: MONTREAL
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The General Electric Co., of Sweden

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The Conduit that is specified for Canada's largest buildings, grain elevators, factories, etc.

New Hudson's Bay Store, Calgary. A Galvaduct Building

"GALVADUCT"

THE most perfect interior construction conduit on the market. Recognised as the standard of high quality.

"LORICATED"

A HIGH class interior construction conduit of the enamelled type. Proof against acid or other corrosive agents.

Always use "Galvaduct" or "Loricated" to carry your wiring and you will have protection and good service.

If Your Jobber Cannot Supply You, Write Us

Conduits Company Limited

Toronto and Montreal

C. G. E. Thomson Watthour Meter

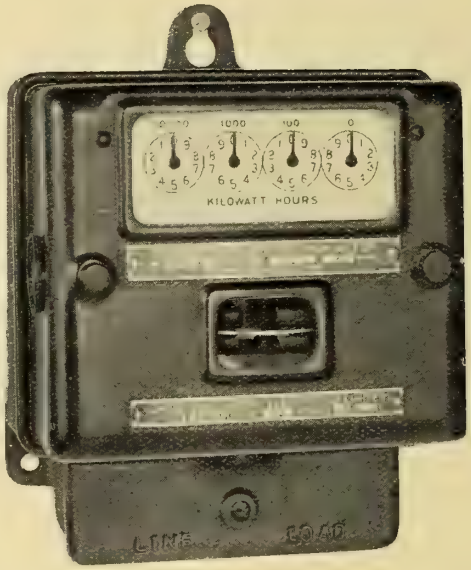
"TYPE I 9"

The Ideal Meter

High Torque

—

Permanent Accuracy



Easily Installed

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Neatly Designed

Supplied with Metal or Glass Cover

The remarkable increase in the demand of the I 9 Meter is ample proof of the perfection of its operation.

We solicit an opportunity to demonstrate to you the superiority of this high class Meter.

Canadian General Electric Co., Limited

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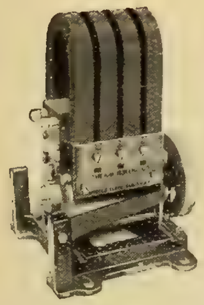
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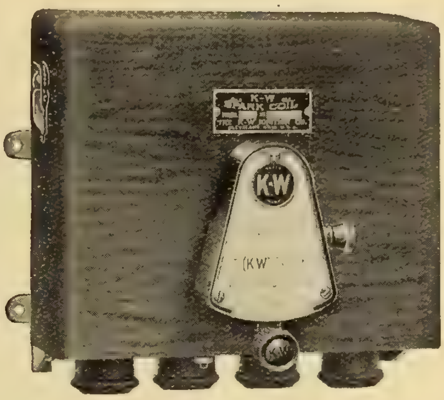
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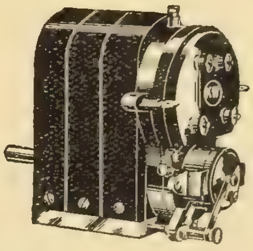
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Insist upon K.W. Coils and Magnetos and protect yourself by the K.W. guarantee.

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Headlights

K.W. Magnetos
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Instruments
Carbureters
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and all other Accessories

Have you received our 1913 Catalogue? Write, if it hasn't come to hand. Everyone interested in Ignition Appliances will find this Catalogue valuable.

Canadian General Electric Co., Limited

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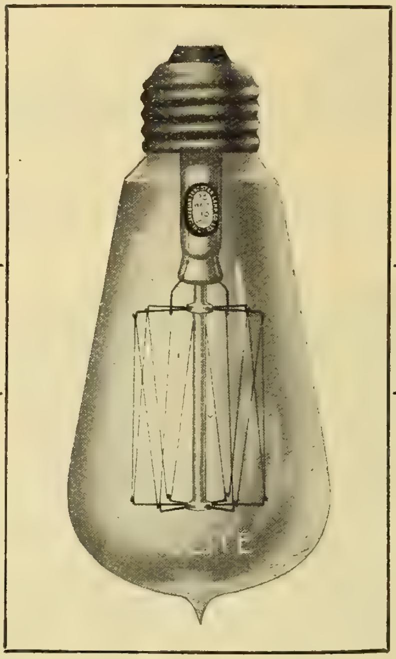

Ductile Filament **Tungsten Lamp**

IMPORTANT

Read this advertisement then consider the factory which stands behind it, and we feel confident that you will be convinced that we are equipped to fill all your needs of "NULITE" drawn wire tungsten and "BRILLIANT" carbon filament lamps.

Have you ever considered that productive capacity of your workman can be increased to 10 to 20% by using Nulite wire drawn tungsten lamps.

Eventually you will replace your old arc lamps with Nulite tungstens and anticipating this, we suggest having you use our 300, 400 or 500 wat "Nulite" which gives a better light and does not demand daily attention through the renewing carbons.

The enormous growth of our business is attestation of the merit of "NULITE" tungsten lamps.

Place your orders where you will be guaranteed shipment, it will pay you to carry a complete range of our lamps and enjoy the satisfaction of knowing you have the best that skill and money can produce.

WRITE FOR QUOTATIONS

The Canadian Tungsten Lamp Co., Ltd.

Hamilton - Ont.

Branches at—
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Winnipeg—56 Albert St.
Vancouver—365 Water St.

Agencies—
St. John, N. B.—T. McAvity & Sons
Halifax, N. S.—Farquhar Bros,, Limited
Quebec, Que.—Mechanics Supply Co., Limited
Toronto, Ont.—Dominion Illuminating Rental Co.

A New Bonding Principle

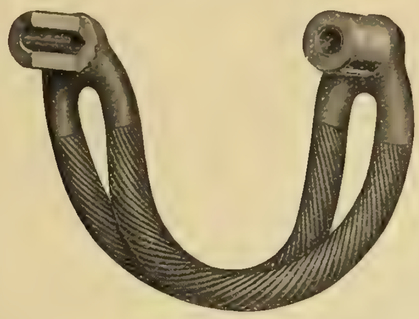

Fig. 1—Type J Bond—Patented Note Hollow Terminal.

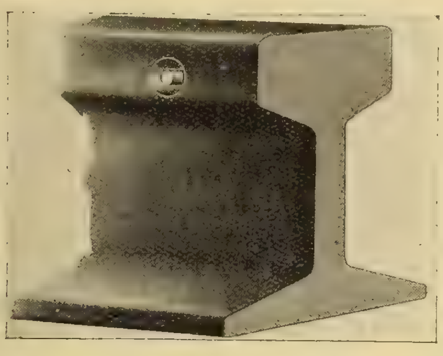

Fig. 2—Annular Hole in Rail

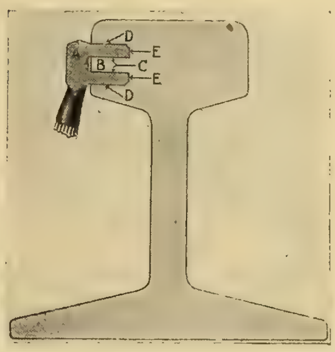

Fig. 3—Section of Bond on Rail.

Novel Features

O-B Type J All-Wire Bond, for ball of the rail, has contact surfaces on both inside and outside of terminal.

Annular hole (Fig. 2), milled in rail by hollow cutter, has a central plug which is an integral part of the rail and makes contact with inner surface of hollow bond terminal.

Permanent Contact

Electrically, contact surface "C" (Fig. 3) is absolutely protected against moisture or other corrosive elements being far removed from outer surface of rail. Contact surfaces "C" "D" and "E" exceed that required for capacity of bond.

Mechanically, the bond is on the rail to stay, as a double gripping effect is obtained upon outer wall "D" and upon pin "B," (Fig. 3).

Rapid Installation

Holes are milled with motor-driven machine—operation very rapid. Bonds are installed in holes with ordinary hammer.

A Prominent Road that has installed many thousands of these bonds, reports that a bonding crew of three men installed from 125 to 150 bonds per ten-hour day,

Full Particulars sent on request.

The Ohio Brass Company

Mansfield, Ohio, U. S. A.

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THE excellent service, lasting qualities and high efficiency of Sunbeam Mazda Lamps have immortalized them in the electrical trade of Canada.

If you would sell your customers the best there is, place your orders for

Sunbeam Mazda Lamps

These lamps have a continuous drawn wire tungsten filament that will stand considerable jar and vibration without injury.

They give three times as much light as a carbon lamp with the same current consumption.

Better light for the consumer means more business for the dealer and central station.

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The Canadian Sunbeam Lamp Company, Limited

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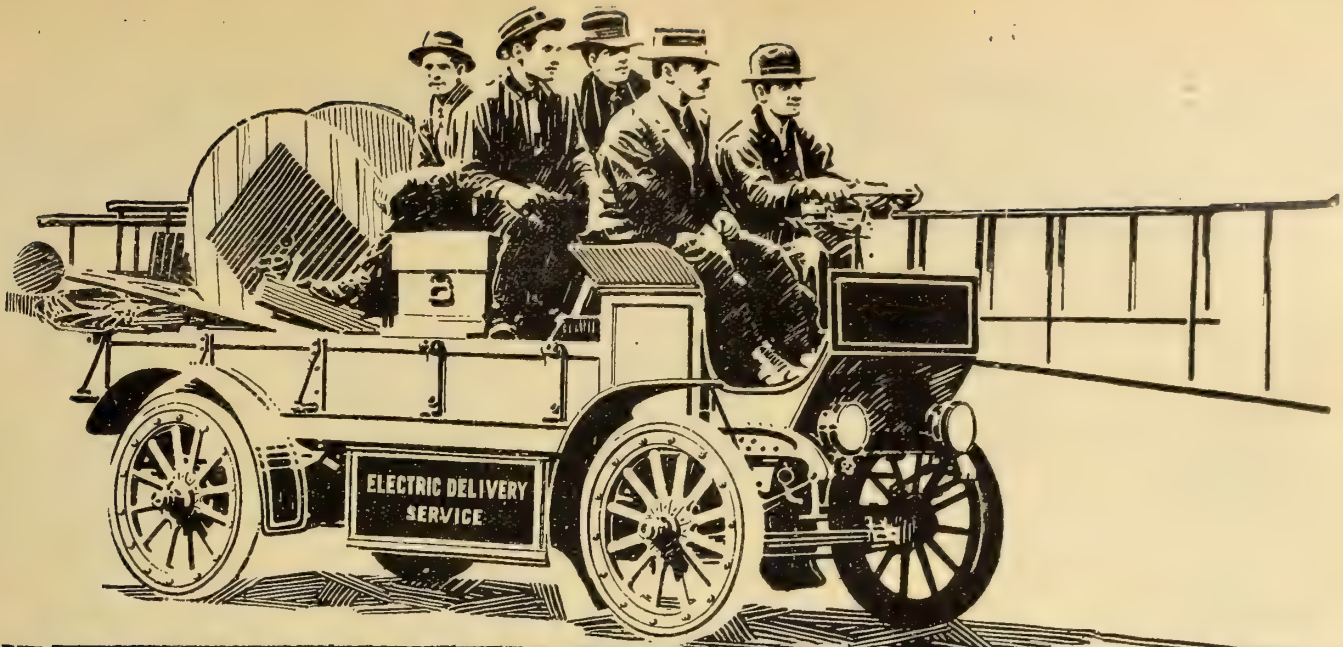

The purchase and use of at least *one* Electric Vehicle is an important first step in any Central Station campaign.

Your use of Electric Vehicles, Mr. Central Station Manager, is the most compelling endorsement of their economy and efficiency.

How can you expect to convince ***others*** of the desirability of Electric Vehicles if ***you*** are not using them yourself?

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And the records you keep as to mileage, energy consumption, service and cost of operation are invaluable when dealing with prospective customers. This is what the progressive Central Station is doing.

We are conducting a nation-wide advertising campaign for the Electric both pleasure and commercial, in a number of national magazines and a long list of trade journals. We want every Central Station in the country to derive the greatest possible amount of individual benefit. We will gladly show you how you can link our national advertising to your local conditions, at little expense. Why not write to-day?

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BOSTON *NEW YORK, 124 W. 42nd St.* *CHICAGO*

(16)

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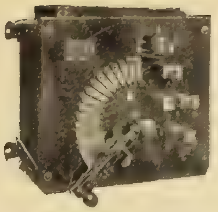
D. C. Motor Starter
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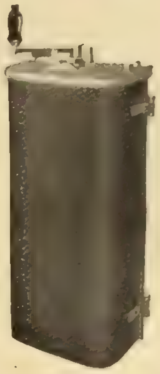
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Speed Regulator for Fans, Pumps, etc.
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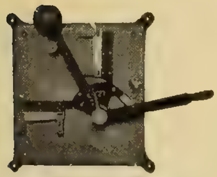
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For the Unusual as Well as the Usual Requirements

Because of the thorough working out of each step in the development of the most extensive line of motor controllers on the market, our engineers know what changes or additions are needed to meet the out-of-the-ordinary requirements.

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The Standard for Twenty Years

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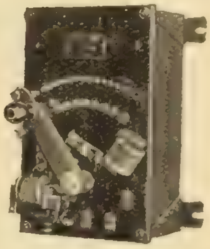
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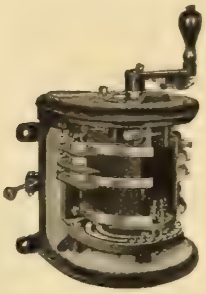
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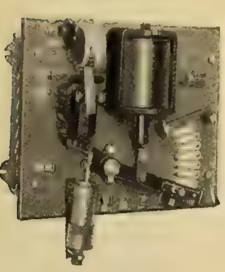
Bulletin 5220


D.C. Self-Starter
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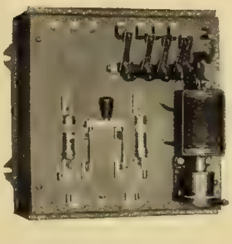
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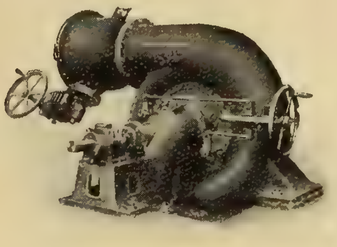

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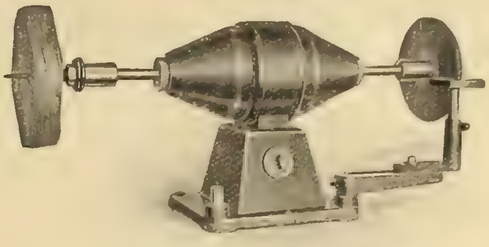

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1. The snap switch for starting
2. The gasketed joints
3. The shaft supported by long bearings
4. The adjustable tool rest
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Electro-Dynamos, by Charles Ashley Carus-Wilson. Published in 1898 by Longmans, Green & Company. 298 pages, Price 50c.

Elementary Lessons in Electricity and Magnetism, by Silvanus P. Thompson. Published in 1895 by MacMillan & Company, 628 pages, illustrated. Price 50c.

Electric Lighting & Heating, by Sydney F. Walker, Published in 1907 by Norman W. Henley Publishing Company. 438 pages, illustrated. Price $1.00.

Dynamo-Electric Machinery, by Francis B. Crocker, E.M., Ph.D. Published in 1908 by American School of Correspondence. 236 pages, illustrated. Price $1.00.

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Explanations of Switch and Signal Circuits. Published in 1907 by Doran & Kasner. 140 pages. Price 40c.

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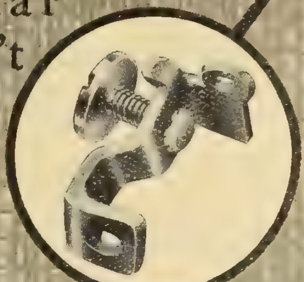
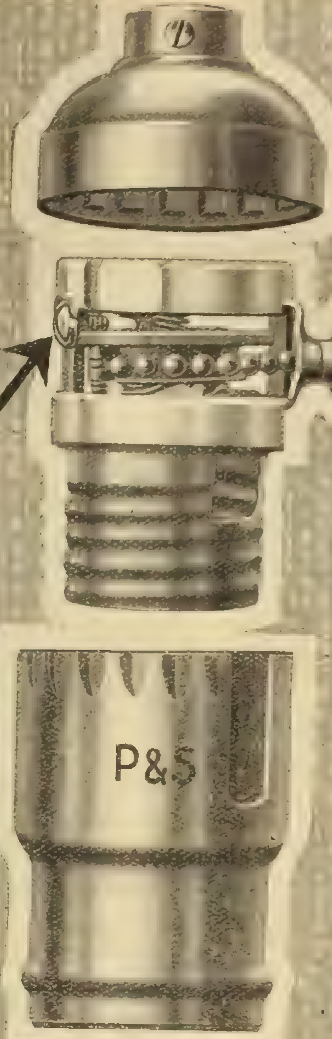
You know it has a habit of rolling into the most inaccessible part of the room.

A collar button isn't in it with the ability of a small screw to get lost.



Enlarged view showing the long "UP-SET" contact screw



That is why P & S sockets have the "UP-SET" contact screws.

These contact screws can come out the proper distance and no further. This distance is ample as the screws are unusually long, in addition to being supplied with a large head.

Ask your workmen what they think about it

They know the time and temper lost in hunting about on the floor for small screws.

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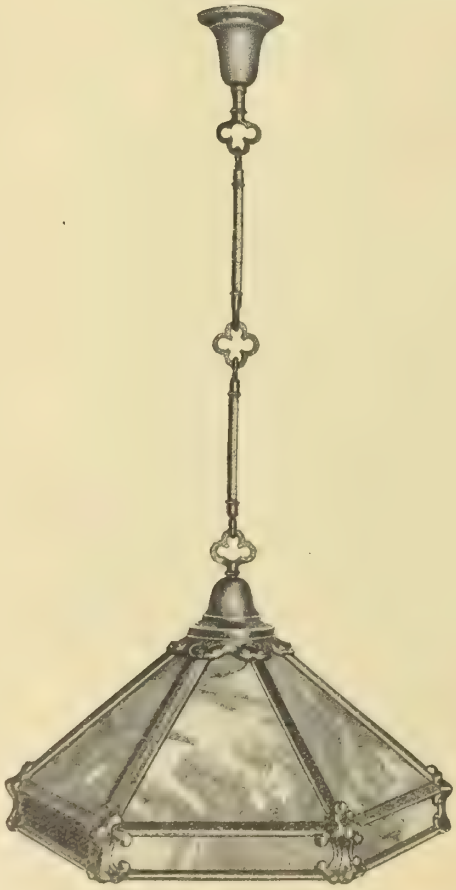

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The "VENUS" Dome is a Beauty

It is built on our patented collapsible feature, saves you time and space, and does not depreciate while in stock. **Order a Sample.** Cat. No. 100a shows this dome.

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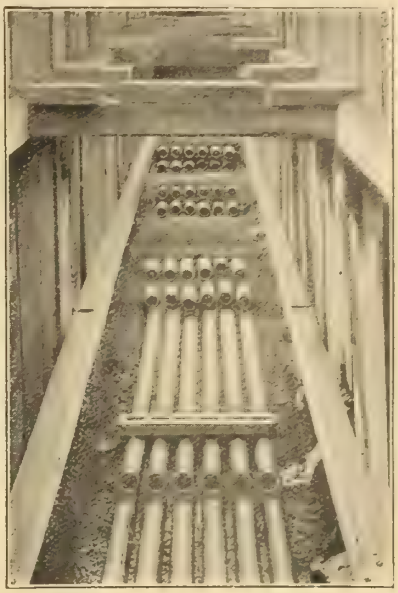

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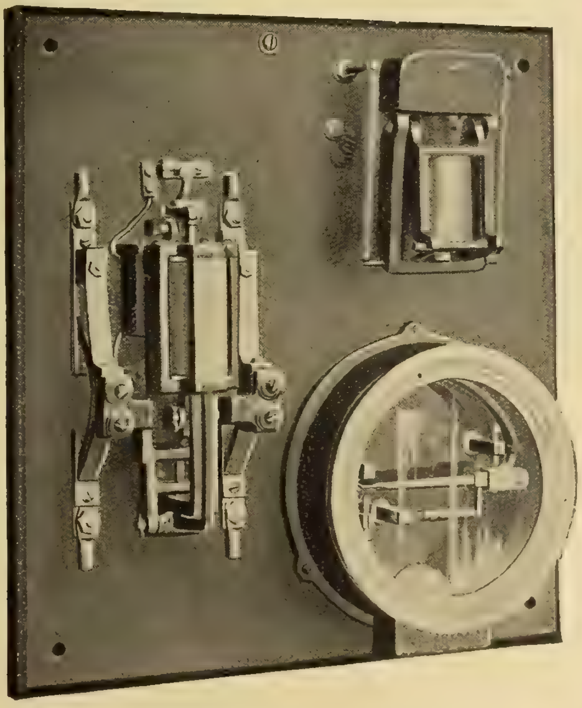

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We manufacture a complete line of controlling devices such as Motor Starters, Pressure Regulators, Tank and Sump Switches, Panels, etc.

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¶ We take this opportunity of thanking our many friends for the business which has made these larger premises necessary and trust that with larger stock and better facilities we may merit a greater share of your patronage in the future.

CHAPMAN & WALKER, Limited

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- Shanghai Municipality.
- Melbourne Electric Supply Co.
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- Societa Dergano.
- Sociedad Espanola, Madrid.
- Societa Electrica Suburbana, Milan. &c.

(MOSCIKI SYSTEM)

Lightning, if unchecked, will break the windings of your apparatus, blow out your fuses and break down your transformers.

In short, lack of adequate and capable lightning protection may mean to you serious loss of time, money, and perhaps lives.

A host of so-called lightning arresters are on the market, but 99 per cent. of them are valueless because the principle on which they are constructed is wrong.

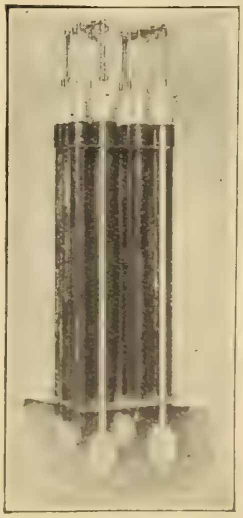
High frequency—not high voltage—is the cause of the damage done by lightning.

Most protective systems work on the principle that high voltage is the cause of the damage. This is incorrect, hence their uselessness.

A lightning protection apparatus to be of any use **must offer a clear path to earth for high frequency currents independent of voltage.**

The MOSCIKI System of Lightning Protection fulfills this condition absolutely—it's principle is correct—its design the best and its guarantee absolute. Write us for fuller particulars.

Mosciki Lightning Arrester



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CHAPMAN & WALKER, ELECTRICAL ENGINEERS AND CONTRACTORS

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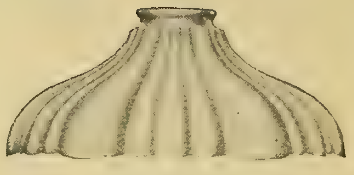

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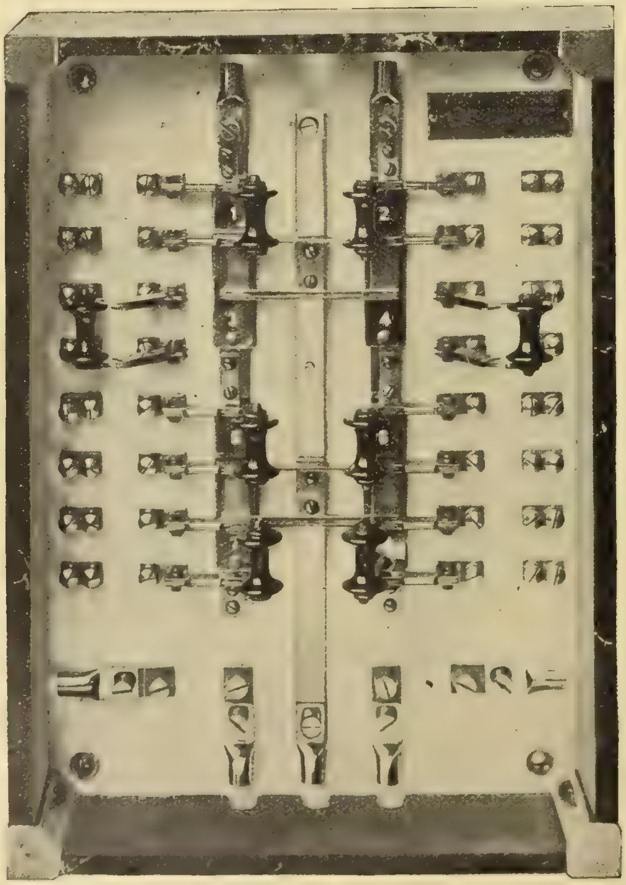

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No. 29 is a **self holding** receptacle, strongly made and sheet metal holder. It requires only a plain **round** hole in sign and thus it is more easily and quickly adjusted. Another point is the fact that the making of plain **round** holes is easier on your punches and makes them last longer than if the hole were notched.

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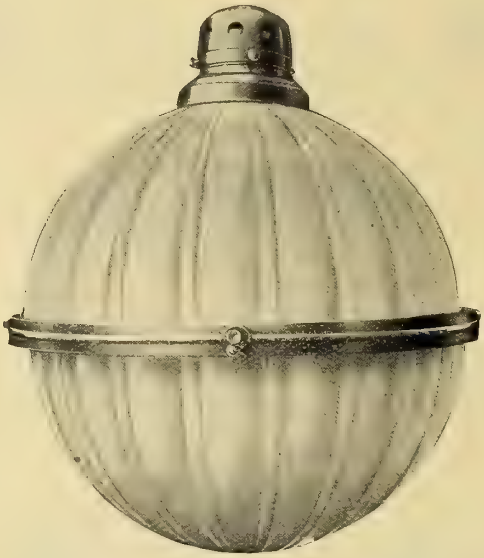

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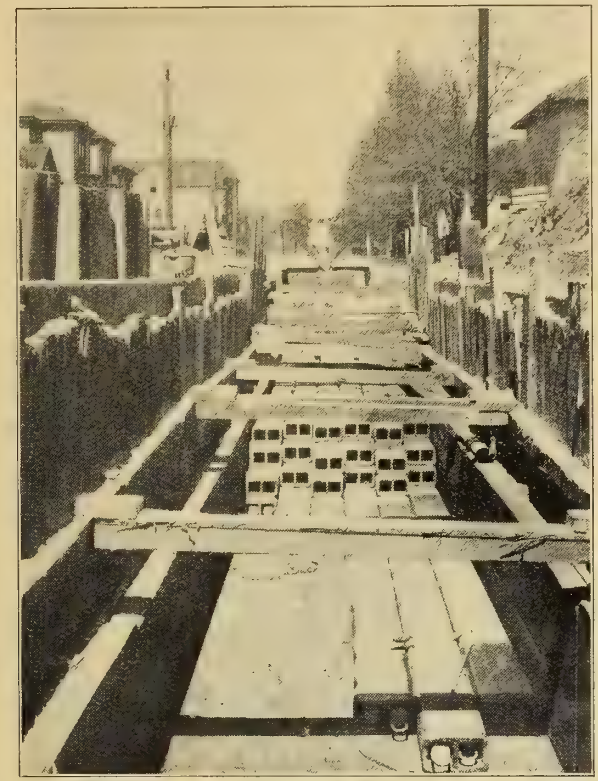

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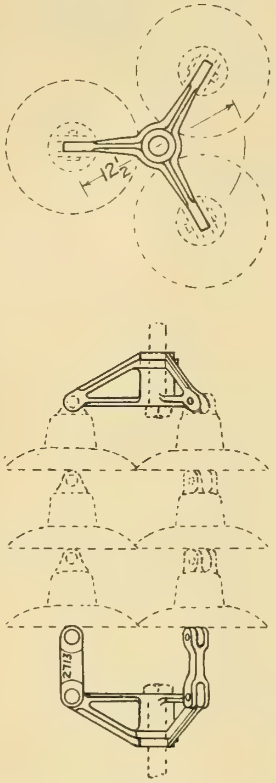
YOKES FOR SUSPENSION INSULATORS



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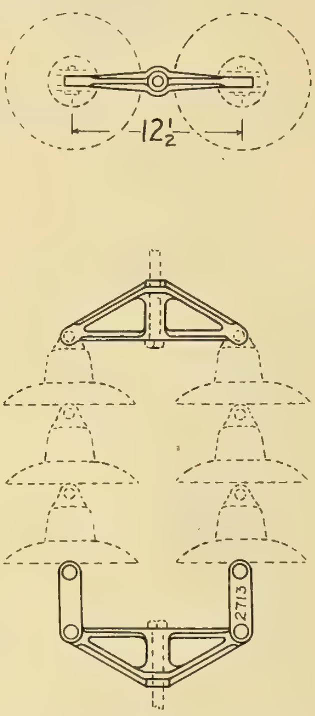

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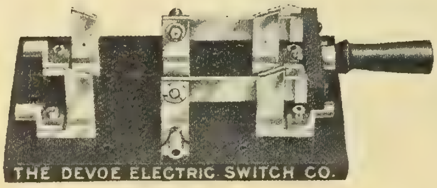

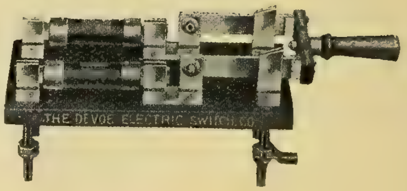

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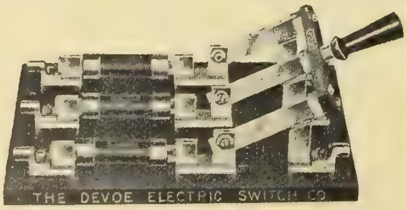
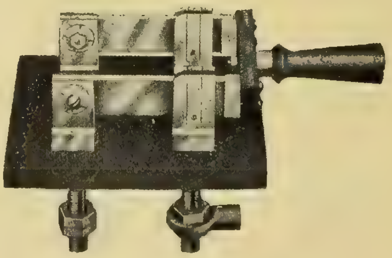
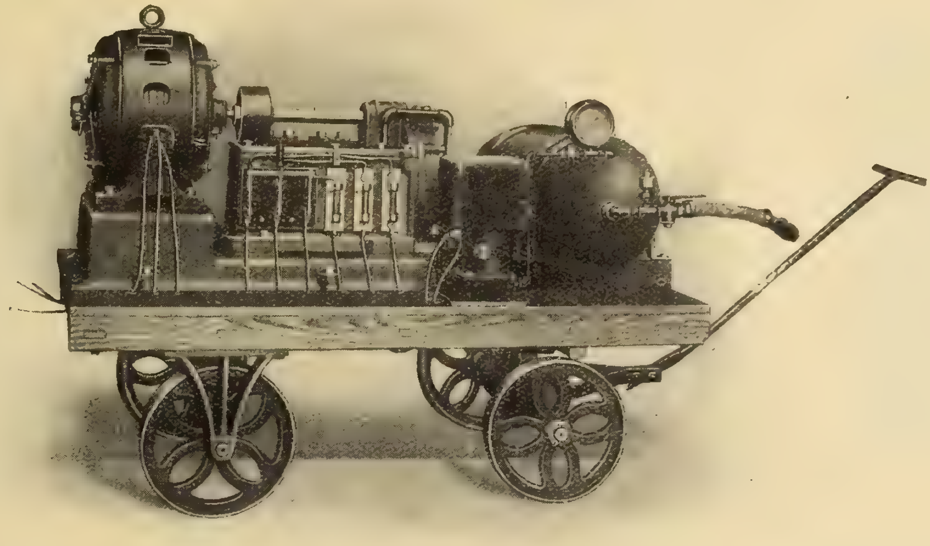




Office and Factory: 157 Craig St. West, Montreal, Canada

PORTABLE AIR COMPRESSORS

FOR CLEANING GENERATORS



Power Houses must, of necessity, have compressed air for blowing the dust from generators and the small portable or stationary compressor meets this need perfectly. If a portable compressor is used it can also be taken to other parts of the works for blowing out motors and machines. Air pressure can also be used for conveying oils or other liquids.

Telephone exchanges, both manually operated and automatic, find the portable compressor of great assistance in keeping dust from accumulating on switches and windings and thus causing trouble.

These compressors are designed for drive by either direct or alternating current motors of any standard voltage. In all cases the motor is bolted firmly to the compressor. If it is desirable the compressor can be arranged for belt drive.

The use of an automatic governing device, whereby the air pressure is maintained practically constant at all times and by which the motor is automatically started or stopped as often as may be necessary, is a decided advance over older methods. Its use eliminates all necessity for any hand manipulation of switches and allows the compressor to be set in remote or comparatively inaccessible places. The automatic governor can be set to maintain practically any desired pressure. It will, of course, maintain the highest pressure desired but lower pressures can be obtained by the use of reducing valves.

For further particulars

See Bulletin 1523

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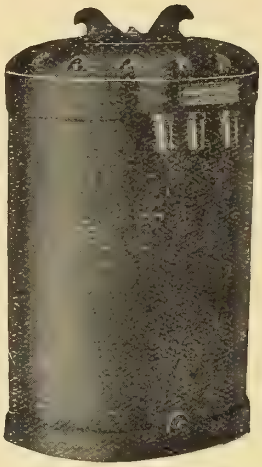
COBALT CALGARY

ALLIS-CHALMERS-BULLOCK LIMITED

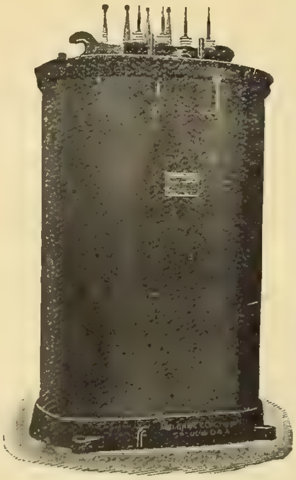
Stop and Figure

Your Transformer Cost

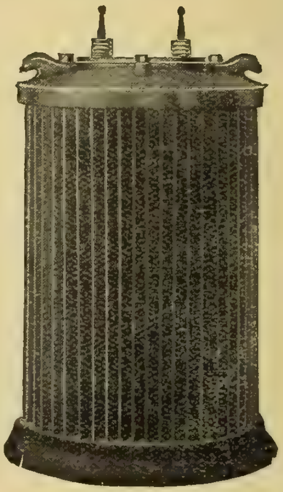


Not the cost of purchase and installation, but the cost of upkeep and copper loss.

Moloney Transformers, owing to the high grade Silicon Steel used in their core and to their perfect design, have reduced core loss to a minimum.



Moloney Transformers will effect a saving of 20 per cent. in one year over ordinary transformers, and in five years the price of a new transformer. This is not an empty statement but a proven fact.



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The Seven Essentials

which must **all** be present in every **successful** installation of indirect illumination.

(1) Most powerful reflectors *made*

to reflect the largest amount of light generated by the lamp against the ceiling, thus attaining the desired brightness in the illumination of the room at minimum cost for current.

(2) Reflectors of *scientific* design

to direct the light rays against the ceiling at the proper angle so that they will be re-reflected from the ceiling to evenly light the room, and corrugated to prevent streaks on the ceiling.

(3) Reflectors of *lasting* brilliancy

so that the illumination does not become dim with the passing of time on account of the reflecting surface deteriorating.

(4) *Scientific* installation to produce known results

The reflectors must be the proper number of inches below the ceiling, the fixtures must be spaced correctly, the bowls must contain the right type of reflector (concentrating or distributing), etc.

(5) *Natural* seeing conditions for the eye to work by

There must be no visible light sources. No sharp shadows. No direct or reflected glare. No blotchy illumination. No light rays striking the eye directly.

(6) *Low* maintenance cost

Washing of the reflectors must be made unnecessary to save time (Labor cost). Handling of the reflectors and lamps must be reduced to a minimum to save breakage. (Equipment cost).

(7) *Variety* and *Harmony* in fixture design

The interior bowl equipment, i.e., the powerful reflectors, the holders to keep them in the right position with relation to the lamp, etc., must be interchangeable and adjustable to special designed fixtures to harmonize with different interiors.

Before we applied science in perfecting X-RAY reflectors, and their appliances, which embody ALL these essentials, satisfactory Indirect Illumination was impossible. Time has not changed this condition!

These powerful X-RAY reflectors and interior bowl equipment are manufactured exclusively by us and used solely with the

EYE COMFORT SYSTEM

of Indirect Illumination

The most complete and best equipped Engineering Department in the country is always at your service.

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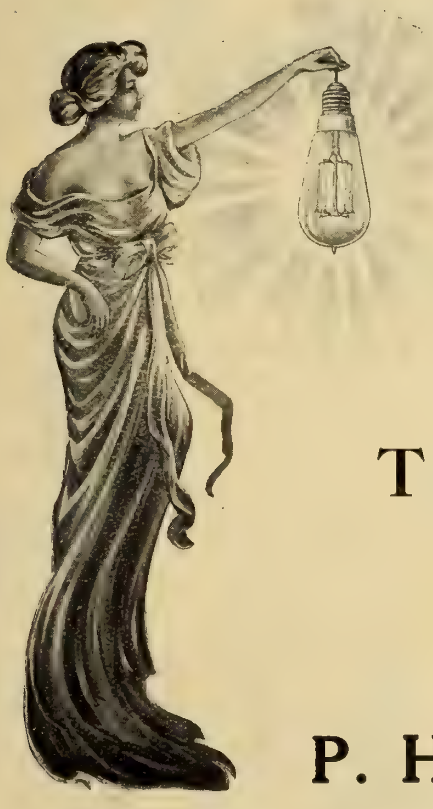

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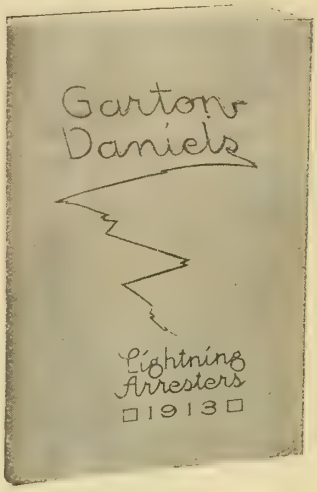
Every Electrical Man Should Have This Book



Every year many men get this book because **they find it of value to them.** From it they get valuable information—up-to-date information, on such subjects as lightning in general; installation of lightning arresters; grounding; distribution; inspection; and it contains the most concise and, we have been told, the **best** section covering definitely, by diagrams, etc., exactly what type of lightning arrester is exactly suited to any given circuit, A.C., D.C. or Arc.

Wouldn't all of this be of value to you?

It also tells and shows **why** the small air-gap, the low series resistance and the circuit breaker **used in conjunction** only in the Garton-Daniels Lightning Arrester have given a lightning arrester which, first of all, does give protection—it can't help it; why no disturbances, winking lights, low voltages, etc., can occur on a circuit when such an arrester discharges; why it is practically impossible for it to ground or short-circuit your lines. In short, why you will get from it **complete lightning protection.**

The only way you can get all this information in one place is from this book The easiest way for you to get a copy is to write and ask us for one **now.**

Garton-Daniels' Lightning Arresters are sold in Canada by John Millen & Son, Limited, Montreal, Toronto, Winnipeg, Vancouver, and by jobbers generally throughout the world.

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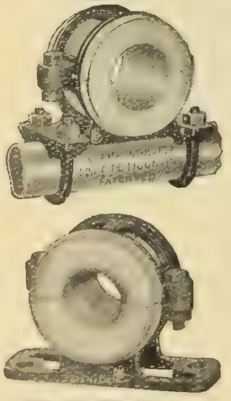

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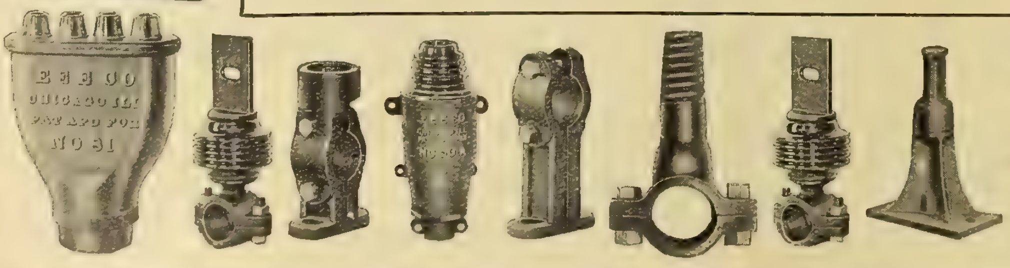

Electrical News
Generation, Transmission and Application of Electricity

PUBLISHED SEMI-MONTHLY BY

HUGH C. MACLEAN, LIMITED,
HUGH C. MacLEAN, Winnipeg, President.
THOMAS S. YOUNG, General Manager.

HEAD OFFICE - - 220 King Street West, TORONTO
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Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Vol. 22 Toronto, March 1, 1913 No. 5

The Micro-thermometer

The Department of Marine & Fisheries has just issued a report of experiments performed with Professor Barnes' micro-thermometer, on an instrument devised to determine the presence of icebergs. The report deals with readings taken on a trip of the C.G.S. Montcalm and on a trip across the Atlantic on board the R.M.S. Victorian. Some extremely interesting and unexpected results are obtained not the least unexpected being the temperature conditions found in the immediate neighborhood of icebergs. In every case as an iceberg was approached it was found that the temperature increased almost uniformly to the extent of about a degree over a five mile circle surrounding the iceberg. This rise in temperature was very marked on the micro-thermometer, which is a very sensitive instrument, and occurred without exception in every set of readings taken as the ship either approached or left a berg so that Professor Barnes is satisfied his instrument will detect the presence of icebergs without fail. In view of the success of these experiments it is evident that much added safety would result in the general adoption, by all steamships, of this device.

In theory the micro-thermometer is a very simply designed apparatus. It consists of a coil of wire of approximately 125 ohms resistance which is enclosed in a metal bulb and placed just below the surface of the water at the side of the ship. This coil constitutes the resistance in one of the four arms of an ordinary Wheatstone bridge. Two of the remaining arms carry constant resistances, the third arm being variable. As the temperature of the water varies the resistance of this coil also varies so that the temperature of the water is easily calculated from the resistance readings taken.

Thury System Favored

A report has just been made to the Government of Sweden by Messrs. Holmgren and Centerwall, engineers, on the question of the transmission of 20,000 kilowatts of electric energy, a distance of some 200 miles, between Trollhatten in Sweden to Copenhagen in Denmark. The report deals with the type of generation and transmission best suited to the particular conditions existing on this line which are unusual in that the Strait of Oresund, 3½ miles wide, has to be crossed on the way. The difficulty of transmitting alternating current across this Strait was the chief obstacle and probably the determining factor in the final recommendation of a transmission at 90,000 volts direct current.

At Trollhattèn it will be remembered there is a present development of 80,000 h.p. with sufficient power for 20,000 h.p. addition. Generation is at 25 cycles and the Copenhagen requirements are for 50 cycles. As the requirements of Copenhagen are approximately this 20,000 h.p., the question resolved itself into the most economical method of developing this amount at Trollhatten, transmitting it to Copenhagen, and transforming to 50 cycle a.c. current.

Three general plans were considered as follows: First, the cost of generating and transmitting direct current and converting it into 50 cycle a.c. current at Copenhagen; second, the cost of generating alternating current converting it into direct current at Trollhatten, transmitting by direct current and eventually converting back to 50 cycles at Copenhagen, and third, cost of generating and transmitting alternating current and eventually converting it to 50 cycles at Copenhagen.

The estimated cost of the three systems is given below. Estimates were made on both a wood pole and an iron pole transmission line for the direct current transmission, also a ground return and metallic return. It will be seen from these figures that the direct current system of generation and transmission possesses decided advantages in cost over the other methods discussed.

	Total cost, dollars	Annual Expense dollars	50 cy. current available at Copenhagen kw.
Generate d.c.; transmit d.c.			
Wood poles, ground return ..	1,202,000	125,000	11,225
Iron poles, ground return	1,269,200	130,500	11,225
Wood poles, metallic return ..	1,643,700	157,300	10,830
Iron poles, metallic return ..	1,715,300	163,300	10,830
Generate a.c.; transmit d.c.			
Wood poles, ground return ...	1,350,600	141,800	10,040
Iron poles, ground return ...	1,418,600	147,200	10,040
Wood poles, metallic return ..	1,782,700	174,500	9,640
Iron poles, metallic return ...	1,862,000	180,800	9,640
Generate a.c.; transmit a.c.	1,593,000	163,000	10,440

The system of generation recommended therefore, is that known as the Thury system. Instead of two turbine units as originally planned, there would now be four, each driving five generators in series, each generator wound for 4,500 volts. These 20 generators coupled in series would give 90,000 volts at which pressure it is proposed to transmit.

Smoke and Sawdust Abatement

A civic committee which for some months past has been in operation as a "Smoke and Sawdust Abatement Nuisance Committee," at Vancouver, to consider ways and means to obviate those two evils in the city, recently concluded its labors by recommending to the council a proposal from the Public Service Corporation to supply electric light, heat and power to consumers in the city. It is the intention of the company to develop electricity and steam heat from the refuse at the various lumber mills in Vancouver and at the same time do away with a great deal of smoke and sawdust. Broadly speaking, the recommendations of the civic committee were as follows:

The franchise is to be for thirty years, but the company is to have no exclusive right for such a franchise. The city is to have the option of purchasing the company as a going concern after twenty years, and at the end of each succeeding five-year period. Disputes as to price are to be settled by arbitration.

The supply charges to consumers are to be: For electric light, 8 cents per kilowatt hour, to be subsequently reduced to 7 and 6 cents; for heat $1.00 per 1,000 pounds of steam pressure developed by the company. A discount of 10 per cent. if bills are paid within ten days. No meter rents.

In consideration of the franchise the company are to pay the city 1 per cent. on the first ten years' gross earnings, 2 per cent. on the gross earnings for the ensuing five years, and 2½ per cent. for the balance of the term; they also must start operations within 18 months and expend $50,000 within this period, otherwise the agreement will lapse.

Large Producer-Gas Plant

The Canadian Car & Foundry Company of Fort William, Ont., have recently installed three-600 kw., 60 cycle, 3-phase, 500 volt a.c. generators. The generators will be driven by producer gas engines and it is claimed that this will be the largest producer gas engine plant in Canada. The engines are being supplied by the Mesta Machine Company of Pittsburgh, Pa., and are of the single tandem, horizontal, double acting, 4 cycle type, cylinders 28 ins. diameter by 36 ins. stroke, to operate at a speed of 150 r.p.m. The main gas plant consists of four double bituminous coal generator sets furnished by the R. D. Wood & Company, Philadelphia, Pa. This gas plant was originally intended for fuel gas purposes, but as it is necessary to intermittently change from the water gas operations to producer gas, it was decided to utilize the waste, or producer gas for power purposes. This gas will contain more than 10 per cent. hydrogen by volume and is particularly suitable for use in gas engines.

The fuel gas which will be used for furnace work will have a heat value of 300 B.t.u. per cubic foot, and will contain 50 per cent. hydrogen and 50 per cent. of carbon monoxide. The operation of the producers will be such that it will be practically impossible to mix the gases, that is to say, the regulation of the gas will be automatic, eliminating any liability of water gas being carried to the engines. In the use of double generating sets the gas is drawn off the top of one generator and down through the incandescent coal mass of the other, the tar being consumed and converted into gas, thereby increasing the efficiency of the plant. The resulting deposits of soot will be disposed of through a Thiesen washer.

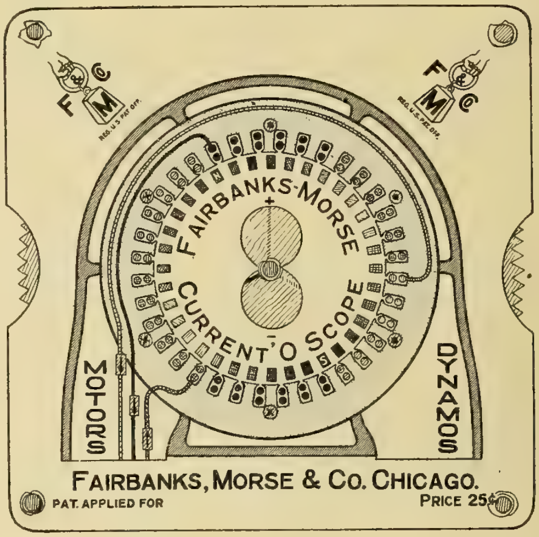
Revolving Field in Induction Motor

We illustrate herewith a device which shows graphically how the revolving field is produced by the action of alternating currents in a three-phase a.c. induction motor. This device is a very clever scheme gotten out by Fairbanks-Morse & Company and named by them the Fairbanks-Morse Current 'o Scope. It will be found especially valuable for students or others who are desirous of obtaining an insight into the theory underlying the operation of induction motors.

An induction motor is in general made up of a stator into which a three-phase alternating current is fed and a rotor containing coils of wire short circuited on themselves. As the current in any phase passes through its different values a condition is created in this stator which is equivalent to a revolving magnetic field. At the same time induced currents in the rotor produce a magnetic field which interacts with the magnetic field of the stator and so produces rotation. It is to study these conditions graphically that this new device has been worked out.

The cut shown herewith is not a fair reproduction of the original device in that the original is made up in colors—black, red and green representing the different phases. The colors are also used for other distinguishing purposes. A fair idea of the work of the device may however, be obtained from the following brief description.

In the centre of the Current 'o Scope there are two circular openings through which will be seen three radial lines representing three phases. These three lines, together with the arrows and signs spoken of later are painted on a circular disc which revolves on a central axis behind the openings shown in the figure. When a line appears in the upper circle it is taken to indicate a current in the positive direction and a line in the lower circle represents a current in the negative direction. Also the length of the lines is calculated to represent the strength of the current at any instant. It will be seen that by revolving this disc the length of the lines will vary from a maximum positive to a zero value, to a maximum negative, back to zero, and finally to a maximum positive again. This represents one cycle. In the same way by turning the disc through stated angles the relation of the current values in the three phases at any instant can be determined.



The outer part of the diagram shows the frame, core and windings of a two-pole, three-phase induction motor. The arrows running around the core on the left hand side indicate the lead wires. As the disc is turned arrows appear through the slots as indicated, which show the direction of the currents in the different phases at any instant. Crosses, dots and zeros also appear through the openings as shown to indicate the direction of the current, a cross meaning that the current is flowing away from the observer, a dot indicating currents flowing towards the observer, and a zero indicating no current. The shaded portions of the disc, which in the original are red and black, show through the inner rectangular slots and indicate the strength and direction of the magnetic field produced by the combination of currents flowing in the three phases. The deeper shaded portions where the letters N. & S. appear indicate the point of maximum field strength, and the lighter shaded portions indicate the gradual weakening of the field on either side of these points.

Victoria has eight public charging stations for electric pleasure cars and trucks.

Telegraph Statistics of Canada

A copy of telegraph statistics of the Dominion of Canada for the year ending June 30th, 1912, is just to hand. The statistics were obtained from telegraph companies under authority of an amendment to the railway act passed by parliament in 1911 and is therefore the first statistical report on the telegraph interests of Canada. The statistics, however, are not complete in that they relate only to companies engaged in the commercial telegraph business and have no reference to railway telegraph interests. However, where companies conduct both a commercial and a railway telegraph system a report has been made on the commercial end of the business.

Geographically, it might be said that the Maritime Provinces are served by the Western Union, the Canadian Pacific and the Anglo-American Companies, although the last named is leased and operated by the Western Union. The Dominion Government operates lines in the unsettled sections of the lower Provinces, chiefly as aids to navigation. The Central Provinces of Ontario and Quebec are served by the Great North Western, the Canadian Pacific and the North American Companies, as well as by the Temiskaming & Northern Ontario Railway Commission. The Western Provinces have the lines of the Canadian Pacific, the Great North Western, the Grand Trunk Pacific, the Canadian Northern and the Dominion Government.

The pole mileage operated in Canada for commercial purposes according to the report amounts to 40,785; the wire mileage to 167,939. These figures are made up as follows:—Nova Scotia—pole mileage 2,828, wire mileage 9,878; New Brunswick—pole mileage 1,867, wire mileage 8,376; Prince Edward Island—14 miles and 14 miles; Quebec—7,515 and 24,249 miles; Ontario—10,514 and 58,207; Manitoba—3,803 and 18,184; Saskatchewan—5,382 and 21,257; Alberta—2,895 and 14,491; British Columbia—3,467 and 10,571; Yukon—2,498 and 2,713. It will be seen that there is an average of a little over four wires for each pole represented. The public service of telegraph companies operating in Canada was represented in the transmission of 9,252,540 land messages and 768,559 cablegrams during the year. The total number of employees reported was 4,828; the salaries and wages paid, amounted to $2,703,032.

The report contains also a quantity of interesting historical information with reference to the early days of the older companies. In this connection the following paragraph will be of interest as showing that the first Canadian telegraph line was operated in 1846. In the United States a line had been opened for public business one year earlier. It was written by Mr. A. F. Easson, whose association with Canadian Telegraphs dates back as far as 1849.

"As early as 1846, T. D. Harris, a hardware merchant of Toronto, and a few public spirited Canadian gentlemen associated themselves into a company to secure the construction of a line of Morse telegraph between Toronto and Niagara, via Hamilton and St. Catharines. The money needed was easily raised, and when at last the company was fully organized it was named 'The Toronto, Hamilton, Niagara & St. Catharines Electro Magnetic Telegraph Company,' with a capital of $16,000, and for which a suitable charter was procured. The line was built by Samuel Porter, long and favourably known in United States telegraphic circles. It will be remembered that a telegraph line between Washington and Baltimore was first opened for public business in the United States on April 1st, 1845. Up to that date the line had been worked by Prof. Morse and his associates as a curiosity. Mr. Porter suspended a wire across the Niagara River to connect the wire at Queenston with Lewiston, N.Y., and built for this first Canadian telegraph company an honest and well appointed line."

Personal

M. Jno. W. Williams, secretary-treasurer the London Street Railway Company has resigned.

Mr. A. G. Sangster, electrical superintendent for the last three years of the Saskatoon municipal system, has resigned.

Mr. Albert Wheaton, electrical inspector for Saskatoon for the past eighteen months, has resigned to go into private business.

Mr. Edward Hanson, late of the Montreal Light, Heat & Power Company, has been appointed electrical superintendent of light and power in Saskatoon.

Mr. R. M. Hannaford is acting chief engineer of the Montreal Tramways Company, following the resignation of Mr. J. D. Evans, chief engineer, a few weeks ago.

Mr. Louis W. Pratt has been appointed sales manager of the Hamilton Cataract Power, Light & Traction Company, Limited, with Mr. W. E. Goring, assistant sales manager.

Mr. White, formerly superintendent of the city electrical department, Saskatoon, has been appointed superintendent of the new street railway system which went into operation there January 1.

Mr. Frederic Nicholls, president the Canadian General Electric Company, visited Vancouver recently in connection with the affairs of the company. The C. G. E. has a branch at 1065 Pender street west, Vancouver.

Mr. W. A. Ostom, chief electrician in the Saskatoon power house for the past year, has resigned to again enter the employ of the Canadian General Electric Company, as superintendent of construction in the west.

Mr. R. H. Sperling, general manager of the B. C. E. R. Co., spent a few days with the Victoria officials at the end of January. Mr. Sperling was much pleased with the progress in Victoria since his visit to England.

Mr. F. J. Gibbons has been appointed sales manager of the Jefferson Glass Company, succeeding Mr. Griffith who is returning to the United States. Mr. Gibbons was formerly sales manager of the Macbeth-Evans Glass Company.

Mr. Julian C. Smith, superintendent of the Shawinigan Water & Power Company, Montreal, has been made a member of the Institution of Electrical Engineers. There are now eight members in the Dominion of Canada.

Mr. Seth B. Smith, who until recently was the Vancouver manager of the Hinton Electric Company, Victoria, is now the Vancouver representative of the Canadian Moloney Electric Company of Windsor, Ont., with offices in the Vancouver Block.

Mr. R. S. Kelsch, Montreal, has left for a long holiday in the West. He has lately been under the weather but hopes to return with much improved health. Mr. Kelsch will visit, among other places, Vancouver, Seattle, San Francisco, and Los Angeles.

Mr. Alfred Still, chief electrical engineer to the Algoma Steel Corporation and for the past year located at Magpie Mine where he has had charge of the installation of a generating plant and transmission line, has resigned his position to associate himself with the School of Electrical Engineering of Purdue University, Lafayette, Ind.

Mr. Alvin Schlarbaum, B.A.Sc., '09, has severed his connection with Messrs. Smith, Kerry & Chace as assistant engineer on the Healey Falls development, to accept the position of hydro-electric engineer for the Riordan Pulp & Paper Company, Limited, of Hawkesbury and Merritton, Ont. The above company plan to develop 9,000 h.p. on the Rouge River to meet the demand of recent extensions to their plant,

Telephone Statistics

A copy of telephone statistics of the Dominion of Canada for the year ending June 30th, 1912, contains much interesting information on telephone operations during the past year. The number of companies making a statistical return to the government totalled 683, an increase of 146 over the previous year. It is not considered probable that the department has a complete list of telephone companies operating, as it is very difficult to get the names and addresses of all telephone organizations. The report however, is believed to give a reasonably full account of telephone interests in Canada.

In the provinces of Manitoba and Alberta practically all the telephone companies have been absorbed by the provincial governments. In Saskatchewan this process of absorption is in progress although there are approximately 200 distinct corporations still operating on an independent footing. In Ontario and Quebec the Bell Telephone Company operate by far the greater number of telephones but the number of independent systems is rapidly increasing. The conditions in the various provinces as regards companies and the number of telephones they operate is as follows:

Ontario—a total of 369 organizations made up as follows: Municipal 27, stock 133, co-operative 97, partnership 28, private 84. The total number of telephones in service is 172,506, of which the Bell Telephone Company have 119,843 These telephones are about evenly divided between central and magneto type, there being 89,875 of the former and 82,631 of the latter. Most of the central energy type are owned by the Bell Telephone Company, namely 81,967.

Quebec—the number of organizations is 62 made up of 23 stock, 12 co-operative, 3 partnership, 24 private. The total number of telephones in use is 66,575, of which 45,906 are central energy and 20,667 are magneto. In this case also, the Bell Telephone Company own a very great majority of the telephones or a total of 54,493 of which 44,900 are central energy type.

Saskatchewan—this province stands second in the number of organizations, which totals 206. This includes the government owned system, 4 municipal, 174 stock, 24 co-operative and 3 private. Out of a total of 16,670 telephones in service the government controls 11,014, leaving 5,656 to the other 205 organizations. With the exception of the government system which uses 5,401 central energy units, all the telephones in Saskatchewan are the magneto type.

Nova Scotia—there are twelve telephone organizations in this province operating a total of 14,520 telephones of which 14,098 are operated by the Maritime Telegraph and Telephone Company. As in the other provinces the smaller organizations use the magneto type instrument.

New Brunswick—there are seventeen organizations in this province operating a total of 12,893. Of this number 11,947 are owned by the New Brunswick Telephone Company, the largest number of telephones owned by any other company in the province being 327.

British Columbia—has 31,178 telephones divided among ten organizations. The largest of these is the British Columbia Telephone Company, Limited, with 26,486. The next largest company is the Kootenay Telephone Lines, Limited, with 1500, and the Okanagan Telephone Company, Limited, with 1300. This province operates a very large percentage on the central energy plan, the British Columbia Telephone Company alone having 21,683 of this type as compared with 4,803 magneto.

Alberta—as already stated the government telephone system has absorbed practically all the smaller organizations. There remains however, the city of Edmonton telephone department, still controlled by the city and operating 4,104 telephones. This is an automatic system. At Red Deer the Western General Electric Company, Limited, also operate 250 instruments. The government owns 11,447 instruments.

Manitoba—here also there are only two organizations, and these very small ones, outside of the government system. These are the Miniota and the Pipestone municipal telephone system operating respectively 360 and 378 instruments. The Manitoba government operates 38,797 telephones.

Prince Edward Island—there is only one private company operated, the Prince Edward Island Telephone Company with 1,208 instruments on its lines.

Summed up, of the total number of telephones in service in Canada, 370,884, 212,732 are central energy type and 158,152 are magneto. During 1912 there was an increase of 37,738 in the number of telephones operated by central energy and an increase of 30,387 in the number operated by magneto.

The total number of miles of wire is given as 889,572. This is divided into urban and rural as follows: urban 636,961, rural 252,610. This indicates that there is one mile of telephone wire in use for every 8.1 of the total population of the Dominion and one telephone for every 19.3. There was one telephone for every 2.3 miles of wire. The class of wire used was as follows: galvanized, 271,191 miles; copper, 20,096; overhead cable, 232,393; underground cable, 364,875; submarine cable, 1,015.

The aggregate capital expenditure in telephones is now placed at $46,276,851, though the cost of real property is placed at something over $10,000,000 beyond this figure. This works out to a capitalization of $124.75 per telephone in use. The gross earnings from all telephone companies for the year amounted to about $12,250,000 as compared with a little over $10,000,000 in the previous year. Operating expenses were 74.0 per cent. of gross earnings as compared with 69.32 for the previous year. Gross earnings work out to $33.9 per telephone in use or $13.79 per mile of wire. Operating expenses represent an average of $24.52 per telephone or $10.22 per mile of wire. The total number of employees is placed at 12,783 as against 10,425 for the previous year.

Aluminium vs. Copper Conductors

In view of the large amounts of capital and engineering enterprise put forward in the development of schemes involving the generation and transmission of electric power in large quantities, the British Aluminium Company have prepared an economic analysis of the transmission line side of the question, dealing with the relative merits of copper and aluminium as the conducting material, and have incorporated the results in a publication called "Electric Power Transmission." It is pointed out that the fact that the over head link between the power plant and the sub-station is in many cases 200 to 300 miles in length and that its cost may be anywhere from $1,500 to $3,500 per mile is sufficient justification for drawing attention to this matter. It is emphasized that this economic question is vitally influenced by the choice of conducting material and that the results of careful study and comparison of engineers' reports from all parts of the world go to demonstrate that the use of aluminium as against copper is attended with economic advantages in almost every instance. At average market prices for the two metals the cost of bare conductors for the transmission of a given amount of power with a certain specified voltage drop is some 35 per cent. to 45 per cent. lower for aluminium than for copper. Pole lines erected for carrying aluminium conductors are, for technical reasons, somewhat the more costly, but the net result on the over-all cost is almost invariably in favor of aluminium. The following information taken from this publication has special bearing on the subject in question.

Properties of Aluminium and Copper

Under these circumstances especially, the very decided economy effected by the use of aluminium as against copper conductors is a powerful influencing factor, and in very frequent circumstances the deciding one. Many objections have from time to time been brought against the use of aluminium for bare conductors, but it may by this time be safely said to have lived them down. The fact that such extensive transmission undertakings as the City of Winnipeg hydro-electric undertaking, the Hydro-electric Power Commission of Ontario, The Pacific Gas and Electric Corporation, Energie Electrique du Littoral, Mediterranean, the Rjukanfos A.G. in Norway, and many other important concerns are using aluminium conductors almost exclusively is sufficient testimony to their merits. The principal characteristics of aluminium as an electrical conductor are here set forth.

Conductivity.—The conductivity of aluminium depends upon the purity, and, to a lesser extent, upon the amount of work put upon the metal in its evolution from billet to the finished wire or bar. For electrical purposes, the employment of aluminium of special purity only is recommended, as impurities or alloys of other metals increase the resistance, and are liable to introduce trouble from corrosion. An aluminium conductor of the same resistance and length as a given copper conductor will have an effective cross-section in the ratio of 100 to 60 = 1.666. The effective sectional area of an aluminium conductor is, therefore, 66.6 per cent. greater than that of a copper conductor of same length and resistance, and the diameter will be some 29 per cent. greater.

Weight.—The specific gravity of cast aluminium is about 2.60, but when drawn into wire, this is increased to 2.71. As the specific gravity of copper wire is about 8.95, the relative weight of a given volume of each metal is in the ratio of 8.95 to 2.71 = 3.3. In other words, a copper wire of any given size and length will weigh 3.3 times as much as an aluminium wire of the same size and length. Aluminium, therefore, having a conductivity of 60 per cent. of that of copper, will have a sectional area 1.666 times as great as a copper conductor of the same resistance and length, and the ratio of the weights will be 3.3 to 1.666 = 1.98; that is to say, a copper conductor of any given resistance and length will weigh approximately twice as much as an aluminium conductor of the same resistance and length.

The weight of an aluminium conductor being only half that of equivalent copper, it follows that the cost of transport, erection, and handling will be proportionately less, and consequently, at anything under twice the price per lb. of copper, it will be more economical to employ aluminium.

Tensile Strength.—The tensile strength of aluminium depends largely upon the amount of work that is put upon it during its evolution from the billet or slab to the finished article. It is usual for extensive undertakings embodying long span construction, to draw wire having very much greater breaking loads, and this special material usually commands a slightly enhanced price. In stranding aluminium wire, it is not good practice to employ strands of a smaller size than 12 S.W.G., as the stresses are more evenly distributed in a cable of few layers. Use has been made in some quarters of a soft-drawn or hemp core, but neither practice is to be commended, the most satisfactory method being to strand in the usual way, feeding the core slack into the stranding machine, so that the outer layers take the major part of the pull.

Temperature-Resistance Coefficient.—The coefficient of increase of resistance with temperature varies somewhat with the extent and nature of the impurities present, and the temperature range over which it is taken, but is in all cases somewhat lower than for copper. Tests made on different samples of commercially pure aluminium give figures varying from between .32 and .39 per cent. per degree C. between 0 and 50° C. compared to .38 to .43 for copper.

Expansion Coefficient.—The coefficient of linear expansion being somewhat greater with aluminium than with copper, due allowance has to be made for this when installing.

The physical, mechanical and electrical properties of aluminium and copper are compared in the following table:—

Chemical symbol	Al.	Cu.
Atomic weight	27	63.2
Atomic volume	10.6	7.2
Position in electro-chemical series	10	24
Melting point, degrees Centigrade	625	1,060
Melting point, degrees Fahrenheit	1,150	1,940
Specific heat (water = 1)	0.212	0.094
Thermal conductivity (silver = 100)	31.3	73.6
Electric conductivity (silver = 100)	58.5	97.5
Coefficient of linear expansion per °C.	.0000234	.0000167
Coefficient of linear expansion per °F.	.0000130	.0000093
Specific gravity, cast	2.60	8.78
Specific gravity, rolled or drawn	2.71	8.95
Tensile strength in lbs. per sq. in.	20,000—30,000	40,000—60,000
Tensile strength in kgs per sq. mm.	15—20	30—40
Elastic limit as % of tensile strength	60%	65%
Modulus of elasticity in lbs per sq. in.	9,000,000	16,000,000
Modulus of elasticity in kgs. per sq. mm	6,330	11,200
Specific resistance in microhms per cm. cu. at 60° F. (15.5° C.) Soft	2.827	1.696
Hard	2.884	1.730
Specific resistance in microhms per cm. cu. at 0° C. (32° F.) Soft	2.667	1.582
Hard	2.768	1.614
Resistance of conductor 1,000 yds. long by 1 sq. in. cross section Soft	.04008	.02404
Hard	.04089	.02453
Coefficient of increase of resistance with temperature Per °C.	.0032—.004	.0038—.0043
Per °F.	0018—.0022	.0021—.0024
Weight per 1,000 yds. by 1 sq. in. nominal section, lbs.	3,520	11,700
Weight per 100 ft. by 1 sq. in. nominal section, lbs.	117.3	392
Ratio of conductivities for equal area	.6	1.0
Ratio of areas for equal resistance	1.66	1.0
Ratio of diameters for equal resistance	1.29	1.0
Ratio of weights for equal area	1.0	3.3
Ratio of weights for equal resistance	1.0	2.0

High-Voltage Losses.—Referring to high tension losses the article says:—A very pronounced phenomenon of present-day high-tension transmission is the loss which takes place due to corona discharge. This is a subject which has received considerable study and it may now be said that its laws are fairly well understood. Briefly stated, the discharge occurs when the critical voltage is reached corresponding to the limiting steepness of the potential gradient for air. As is readily seen, a small conductor postulates a steep potential gradient and a correspondingly low critical voltage. If this critical pressure is lower than the line voltage, a glowing discharge will take place, and involve a serious loss from the line. The only means of keeping the striking voltage up to a safe value is by the use of the largest possible conductor. Here the advantages of aluminium are very pronounced, and as such have been widely recognised. Taking a concrete example, for a .06 sq. inch copper conductor with 10 feet spacing, corona commences at 86,000 volts, while with the aluminium equivalent this becomes 106,000 volts. If, therefore, the line pressure were 100,000 volts, there would be a loss on the copper conductors of about 3 kw. per mile of single circuit line, while on the aluminium lines no loss at all would take place. Stormy weather and high altitudes both reduce very considerably the corona voltage, and augment the losses.

A contract has recently been closed by the S. Morgan Smith Company for the supply to the Ottawa Electric Company of a pair of 48 in. "Smith" cylinder gate turbines of 1700 h.p. capacity, mounted on cast iron draft chest. These are to be placed in an open flume alongside two similar settings furnished by the same company about two years ago.

Homopolar Induction Machines

By Alexander M. Gray B.Sc.*

In the homopolar generator, a direct voltage is established between the terminals of the machine without the use of a commutator. Such a machine is shown diagrammatically in Fig. 1; the copper drum A cuts the uniform field produced by the exciting coil B and the induced electromotive-force established between the brushes a and b, due to the cutting of the field by the drum, is constant in magnitude and in direction.

One of the principal objections to this type of machine is that the voltage per drum is comparatively small; a drum 10 inches long, revolving with a peripheral speed of 10,000 feet per minute in a magnetic field having a flux density of 50,000 lines per square inch would have a difference of potential between the two ends of 10 volts. In order to generate 240 volts, such a machine would require 24 drums or conductors connected in series and would therefore require 48 slip rings each running at a surface speed of 10,000 feet per minute, and also 48 sets of brushes each carrying the full load current. In the homopolar machine then, although there is no commutation problem to be solved, there is the problem of designing a collecting device suitable for high rubbing velocities, a problem which is still giving a great deal of trouble.

Much time has been spent in the endeavour to design a homopolar machine which will not require sliding contacts, and the usual result of such wasted energy is a machine such as that shown diagrammatically in Fig. 2; the operation of this machine is based on one if not on two fallacies. If a direct current be passed round the exciting coil B, a magnetic field is produced as shown, and the assumption is made, which may or may not be correct but which has not been proven experimentally, that, as the rotor C revolves, the magnetic field revolves with it, and the lines of force cut the stationary conductor ab generating a voltage therein; it is also assumed that, since the conductor bc is brought out through a large opening and is therefore in a weak magnetic field, the lines of force will slide around the conductor in some way or other without cutting it, or, if they do cut the conductor, that the voltage induced therein will be very small because of the low flux density in the surrounding space.

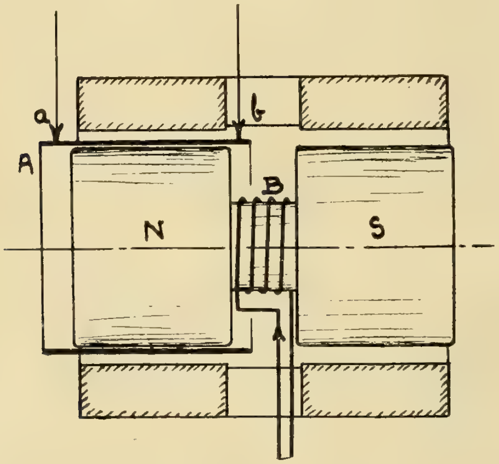


Fig. 1

That this latter assumption is wrong may be shown as follows:—In Fig. 3 a magnetic field as represented by lines of force, the lines passing through iron except at A, where they cross an air space; the flux density in the air space is much lower than in the iron. The direction of motion of the field relative to the iron and air space is shown by the arrow m. In a certain interval of time the line of force ab moves to a_1 b_1; the distance moved through in the iron is small, but that moved through in the air space is large, so that, while the flux density in the air space is low, the velocity of the lines of force in that space is large, and the same number of lines are cut by a conductor in the air space as by a conductor embedded in the iron.

In Fig. 2 the same total flux is cut by conductor bc as by conductor ab, and the voltages induced in these conductors are equal and opposite, so that the resultant voltage measured at the terminals ac is zero.

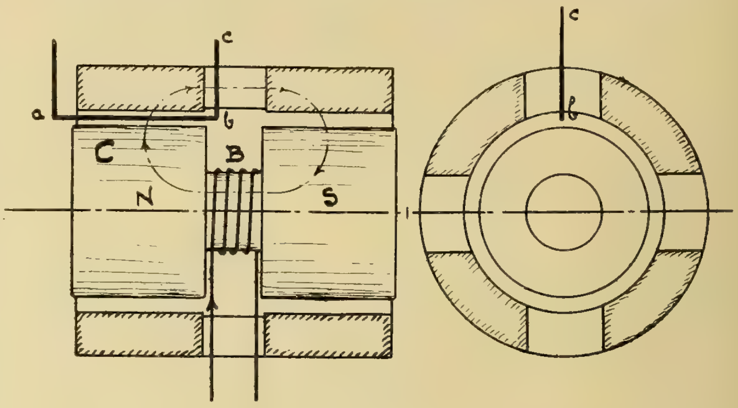


Fig. 2

In 1908 a paper was published by Carl Hering which showed that it was possible to have relative motion of a magnet and a coil of wire in such a way that the flux threading the coil could change and yet there would be no voltage induced in the coil; thus in Fig. 4, a loop L was formed of two flexible strips whose ends pressed together at the joint J, and the circuit of the loop was closed through a galvanometer G. On moving this loop over one leg of the U-shaped permanent magnet N S from the dotted position to that shown in full, an electromotive-force was induced, as is well understood. The magnetic flux has thereby been linked with the electric circuit; the flux enclosed by the circuit has been increased from zero to a maximum; or to use Faraday's terms, the lines of force in the air from one pole to the other, have been cut by the conductor.

If the loop be now moved as shown in Fig. 5 from the dotted position to the one shown in full, by passing the leg of the magnet through the joint J of the loop, but without opening the circuit, the flux and the circuit will be unlinked again; that is, the flux enclosed by the circuit will again be reduced from a maximum to zero, and the circuit will have cut the same lines of force in the opposite direction, as it is well known that all the flux of this magnet passes through its interior; but there is absolutely no electromotive-force induced by this unlinking.

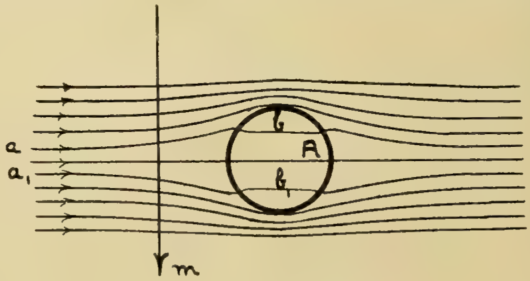


Fig. 3

After the publication of the above experiment the homopolar machine without brushes took a new lease of life and a machine such as that shown in Fig. 6 was proposed, the idea being that, if a revolving uniform field could be produced, this would cut the conductor ab and generate a voltage therein, but would not generate a voltage in the conductor represented by the iron jointing bc, because Hering's experiment, Fig. 5, seemed to show that, since it is possible to move the two contacts relative to the stationary field without getting an induced electromotive-force between the contacts, the converse should also hold namely, that it should be possible to move a magnetic field between two contact points and yet not have a voltage induced between these points. This type of homopolar machine will not give a voltage between terminals, the reason being shown later.

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*Assistant Professor Electrical Engineering, McGill University.

It was found that students had considerable difficulty in understanding these apparently conflicting results, and in order that they might have a definite conception of what is called homopolar induction, the piece of apparatus shown diagrammatically in Fig. 7 was built; its peculiar shape is due to the fact that it was made from pieces of scrap iron.

The iron core A is placed on the end of a motor shaft. The iron yoke D is stationary and carries the stationary exciting coil B. The copper drum C is carried on fibre discs so as to be insulated from the core A and can be rotated relative to that core by a belt operating on the pulley E. The three terminals a, b and c are connected to the three brushes d, e and f; the connection between c and f is a copper wire which is carried through and insulated from the shaft.

When current flows in the exciting coil a magnetic field is established which is represented by the lines of force ϕ_1 and ϕ_2, and if the core A be rotated, voltages will be induced in one or more of the conductors, ad, bd or ef.

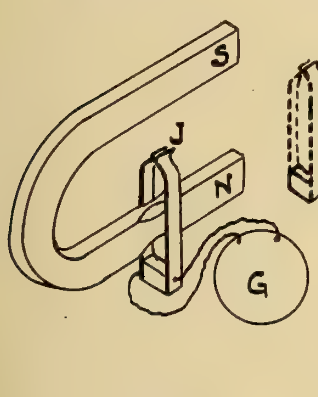

Fig. 4

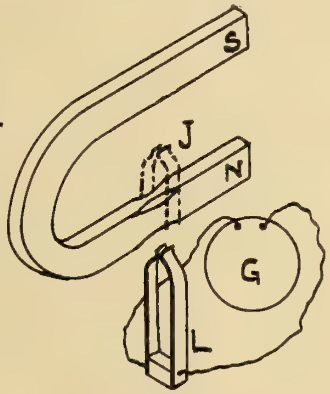

Fig. 5

Whether the magnetic field revolves with the core, or is stationary in space, has not yet been determined experimentally, but to the voltages which can be measured, namely, those from a to b, b to c, and c to a, it makes no difference which assumption is made, for example:—

Let the core A revolve in the clockwise direction and the copper drum C revolve with the core, then, assuming that the magnetic field is stationary in space,

the difference of potential between d and a $= 0$.
between d and b $=$ a const $\times (\phi_1)$
between d and c $=$ a const. $\times (\phi_1 + \phi_2)$
and the voltage between a and b $=$ a const. $\times (\phi_1)$
between a and c $=$ a const. $\times (\phi_1 + \phi_2)$
between b and c $=$ a const. $\times (\phi_2)$

If on the other hand the assumption is made that the magnetic field revolves with the core A then,

the difference of potential between d and a $=$ a const. $\times (\phi_1 + \phi_2)$
between d and b $=$ a const. $\times (\phi_2)$
between d and c $= 0$.
and the voltage between a and b $=$ a const. $\times (\phi_1)$
between a and c $=$ a const. $\times (\phi_1 + \phi_2)$
between b and c $=$ a const. $\times (\phi_2)$

that is to say, the readings that can be taken give no indication as to whether or not the field revolves, but they do show that the conductor cf cuts the total flux $\phi_1 + \phi_2$ during each revolution, even although the flux density in the air space around this conductor is much lower than in the adjoining iron.

An interesting modification of the above experiment is obtained by removing the conductor cf, placing brushes at g and h and connecting them to terminals m and n, as shown in Fig. 8. It would seem at first glance that the line joining the brushes g and h is a conductor which is stationary when brush g is stationary and which revolves in the same direction as brush g when that brush revolves.

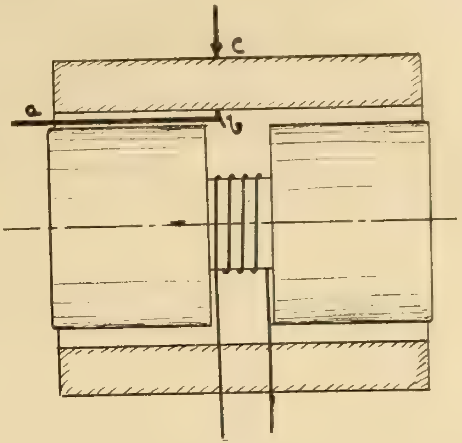

Fig. 6

That this assumption is false was seen from the results, which showed that, no matter whether the brush g was stationary, was revolved in the same direction as the core A or in the opposite direction, the same voltage was obtained in each case between the terminals m and n, and that this voltage was the same as that obtained between a and c in the first experiment, that is to say, the iron between f and g is a conductor which moves in the same direction as the core, no matter how the brushes are moved.

If the above interpretation of a conductor be applied to Hering's experiment, Fig. 5, then his results are readily explained, because when the coil and brushes are moved but the magnet is stationary then the conductor is stationary and does not cut the flux, while if the magnet be moved and the coil and brushes are stationary then the conductor moves with the magnet, at the same rate and in the same direction as the magnetic flux, and again there is no cutting; the voltage between the brushes is therefore zero in each case.

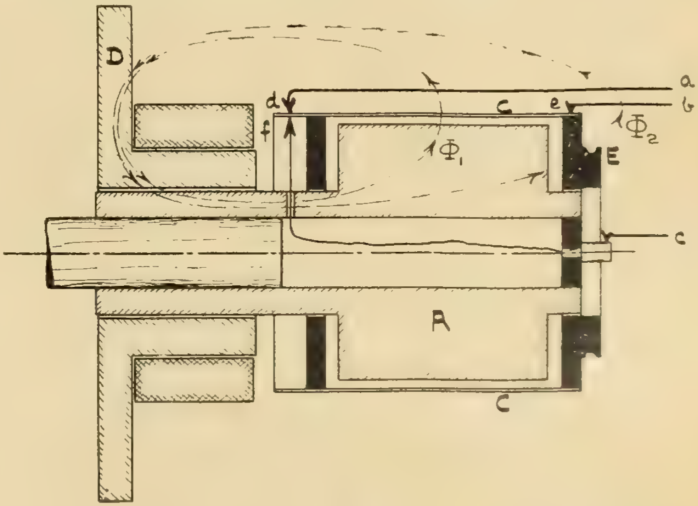

Fig. 7

Many other experiments on homopolar induction may be performed with this piece of apparatus, but enough has been mentioned to show that it is a valuable addition to the equipment of an electrical engineering laboratory.

In conclusion the writer wishes to emphasize the remarks of Carl Hering who, in showing that the law of electromagnetic induction is not stated in such a way as to be readily understood by students, because it is generally stated that the generated electromotive-force in a coil is proportional to the rate of change of flux in that coil, a law which it is difficult to apply to the cases mentioned in this article, says that, in addition to Faraday's statement that "if a conductor cuts magnetic lines of force an electromotive-force is generated," it should be emphasized that the conductor implies the material thing itself when distinguished from a theoretical line representing the closed circuit or current path.

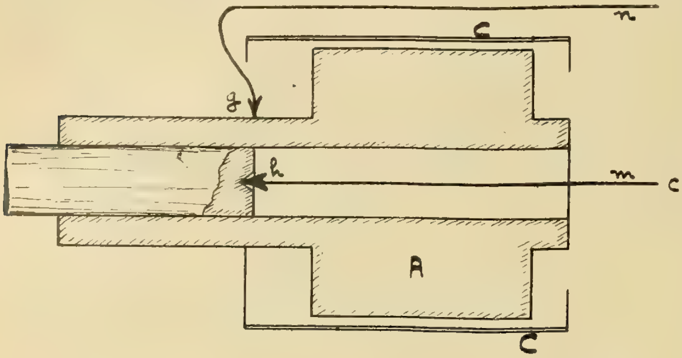

Fig. 8

Montreal and Quebec Activities

In the absence of Mr. J. E. Aldred, president, who is in Europe, Mr. Thomas McDougall occupied the chair at the annual meeting of the Shawinigan Water and Power Company, held in Montreal, on January 18th. The report showed:—

	1912	1911
Gross earnings...	$1,569,671	$1,219,857
Expenses	207,414	160,452
Interest	489,896	436,750
Net revenue	872,360	752,512

Dividend disbursements for the year accounted for $540,000; the sum of $189,375 was transferred to reserve and sinking funds; $25,000 to contingent fund; $103,475 to depreciation reserve, and $24,281 was carried forward to surplus. The gross earnings of the company from all sources increased $349,814, and the net revenue for the year $119,619. By the issuance of $1,000,000 of new stock in October, 1912, at $120 per share, there was realized $1,200,000. The premium on this was carried direct to reserve fund. The directors draw attention to the present condition of the reserve and sinking funds:

In 1908 these aggregated funds stood at ..	$190,000
In 1909 these aggregated funds stood at ...	252,500
In 1910 these aggregated funds stood at ...	342,575
In 1911 these aggregated funds stood at ...	600,000
In 1912 these aggregated funds stood at ...	$1,000,000

The average percentage of operation and general expense to gross income has been, for the past five years, on a basis of 10½ per cent. The ratio for the year 1912 is 9.45 per cent. In the last annual report the Directors advised of the completion of the new development with machinery installed in station No. 2 up to a capacity of 30,000 h.p. In August last it was decided to install a third unit of 15,000 h.p., and this installation is nearing completion. With this unit the total electrical capacity of the two stations will be 100,000 h.p.

The directors also state that the continued demand for power makes it evident that this addition to the plant of the company will be required for use at an early date. As an evidence of the growth of the demand in the last five years it may be noticed that while the total electrical load on the power house (apart from the hydraulic power sold) in January, 1908, was slightly over 30,000 h.p., the beginning of 1913 shows a total demand of over 62,000 h.p. with peaks carrying the total load at times to 80,000 h.p.

The rapid industrial development of the city of Three Rivers makes it expedient to provide for further demands from that point, and the directors have in contemplation, in the spring of 1913, the erection of a third transmission line to Three Rivers. This line will be of steel tower construction with two circuits. The industrial growth at this point is shown by the increase in the electrical load. While in 1908 the sales of power by this company in Three Rivers had not yet commenced, in the present year the electrical load has reached over 12,000 h.p., which will be further increased during the year.

The following executive officers and directors were re-elected:—J. E. Aldred, president; Thomas McDougall, vice-president; Howard Murray, treasurer; W. S. Hart, secretary; Julian C. Smith, chief engineer and general superintendent; directors, R. M. Aitken, London; H. S. Holt, Montreal; John Joyce, Boston; Sir William Mackenzie, Toronto; Sir M. Mitchell-Thompson, Bart., Edinburgh; Denis Murphy, Ottawa; W. R. Warren, New York; E. R. Wood, Toronto.

Montreal Tramways Co.

Mr. R. M. Hannaford, acting chief engineer of the Montreal Tramways Company, lectured before the Canadian Railway Club, Montreal, on "Electric Railway Construction." The lecture was chiefly of a popular character, Mr. Hannaford outlining the history of the company and speaking of the difficulties in track laying. He remarked that in 1863, two years after the incorporation of the Montreal Street Railway, the company carried 1,066,845 passengers as compared with 139,406,295 in 1912. The company had received its charter on May 18th, 1861, to operate in the city and parish of Montreal, and awarded its first contract for building and operating the first section of the road on August 17th. This section consisted of six miles of single track, with an equipment of eight passenger cars. Four years ago, when the company was re-laying tracks on St. Catherine street, the workmen came upon some of the original ties, submerged nearly three feet beneath the pavement, which showed that the street had been raised that much in recent years. The people who found time to complain about the workings of a street railway did not know the difficulty met with in constructing lines. The people who would complain of service were the same who complained of the company leaving their equipment and excavation near their premises when laying new tracks or repairing old ones.

In referring to track laying, Mr. Hannaford stated that in a city, like Montreal, where the streets were narrow, and the larger cars were used, it was impossible to construct curves sufficient to permit the passing of two cars around inside and outside curves at the same time. Thus one car had to remain standing until the other rounded the curve, and this, he stated, accounted to a great extent for the congestion so much complained of. Mr. Hannaford also commented on the expense of cleaning the streets in winter. In the early days of the company, it had been claimed impossible to keep the roads open all the year round, and therefore, the winter traffic had to be carried in sleighs. Public opinion then ran strongly towards the contention that the first snowstorm would block the railway for the winter, while to-day, by the precautions taken, the tracks were kept clean. Records showed that between the years 1875 and 1891, the snowfall had been 118 inches; between the years 1891 and 1912, it had been 117 inches; the least snowfall was 7 inches, in 1894, while up to January 31st of this year, 50.4 inches had fallen, which was one inch more than had fallen up to the same period last year.

Electrical Association of Province of Quebec

Most of the discussion at the annual meeting of the Electrical Association of the Province of Quebec, held in Montreal, concerned the future of the society. Mr. Clarence Thomson presided. Mr. L. E. Simoneau raised the question as to the compulsory licensing of contractors and wiremen, and instanced a case where he had been asked to quote on a small job; after giving his price he was informed that a wireman would do the work for a third of the amount he had quoted, the wireman working at night; no doubt this man would be able to get the underwriters' certificate, and the association ought to be able to stop this unfair competition. Mr. Ellis suggested that the association might amalgamate with the Sons of Jove. Mr. Shaw remarked that the contractors apparently did not care to join the association. Mr. N. Simoneau was in favor of continuing the association, as there was plenty of room for it. In reply to a suggestion by Mr. McLaughlin that the contractors should be canvassed, the chairman said that this had been done, but not with great success. Mr. McGregor was of opinion that the new officers might see if they could infuse more vitality into the association. Mr. Shaw stated that the Sons of Jove were about to consider the question of compulsory licensing, and said that the associations might work together on this matter. Mr. St. Amour said that, if the association could not increase its membership within the next twelve months, they might amalgamate with the Sons of Jove. The following officers were elected: Hon. president, Mr. Clarence Thomson; president, Mr. L. Rousseau; vice-president, Mr. C .E. McGregor; hon. secretary-treasurer, Mr. S. W. Smith; executive committee, Messrs. N. Simoneau, E. W. Sayer, C. P. Ellis, J. A. Valois, and J. A. St. Amour.

Valuable Islands

Judgment has been given in a long drawn out legal fight between the Cedars Rapids Manufacturing & Power Company and the estate de Beaujeu concerning three islands in the St. Lawrence which the company desire to utilize for their power scheme. The tender of the company for two islands was $4,200—$2,500 for Isle aux Vaches, and $1,700 for Isle au Point. The Superior Court award for these islands was $80,000 and $62,000 respectively. The tender of the company had been approved by a board of arbitrators, but the estate de Beaujeu took the matter to appeal before the Superior Court. The judgment handed down by Mr. Justice Davidson is a vindication of the rights of riparian proprietors to the power possibilities of the waters fronting their holdings, the tenders of the company made in the first instance representing the actual intrinsic value of the land considered apart from contiguous water power possibilities. An action entered against a tender of $200 made by the company for Isle Bedard was maintained by the Court, but the question of this island is to be re-opened, the estate claiming $34,000 for the property.

Will Report on Underground Plans

The controllers of the city have been requested to study the question of the city constructing a system of underground tramways. The motion asks that the controllers make an exhaustive inquiry into the question of "determining the most acceptable means of (a) relieving the congestion and the overcrowding of travel in the city, as well as (b) devising a scheme to meet all the future requirements of the public, commensurate with the ever-growing expansion and development of Montreal. That the Board of Commissioners, in their consideration of this all important question, be requested to carefully examine and report upon the establishment of a subway service, similar to that in existence in several larger European and American cities, said service to run north and south, and east and west, by means of double or more tracks. That the Board also consider the advisability of the city undertaking the construction of said proposed subways and leasing the same to an operating company at a rental which would enable the city to meet interest charges and sinking funds, in order that the loan, made in this connection, might atuomatically be paid off at its maturity." The report of the committee of aldermen on reducing the number of street car stops was likewise sent to the controllers, so that the board and the council may act together.

A Jovian Club

The Montreal members of the Sons of Jove have decided to establish a club, and secure headquarters for all those interested in the electrical industry. This was decided on at a meeting held under the presidency of Mr. James Bennett, the statesman. The following officers were elected: President, Mr. James Bennett; vice-president, Mr. D. H. Ross; secretary, Mr. A. M. Muirhead; treasurer, Mr. Watson Jack; auditors, Mr. Gordon C. Bowie and F. W. Wiggins. Executive committee: Messrs. W. R. Shaw, chairman; W. J. Doherty, P. T. Davies, James Bennett, D. H. Ross. Membership committee, W. M. Turnley, chairman; A. J. Carroll, C. B. Ellis. Other committees appointed were: Finance, Mr. W. P. Baird, chairman; House, Mr. F. J. Parsons, chairman; Publicity, Mr A. J. Johnson, chairman.

St. Catharine Street Conduits

The Public Utilities Commission on February 20th had before them the plans of the Montreal Electrical Commission for constructiong underground conduits on St. Catherine street. Objections were heard, but the various companies ultimately agreed upon the plans, and these will be signed by the Commissioners when the alterations agreed upon are made. Dr. Herdt, the chairman of the Electrical Commission, in reply to a question as to what provision had been made in laying the conduits for additional companies coming in, stated that there would be enough room to lay wires which would give another company the same capacity as that of the present companies.

Lease for 75 years

It is officially announced by the Hon. Jules Allard, Minister of Crown Lands of the Province of Quebec, that the Government have decided not to sell any more water power but will lease the water powers for 75 years. They will allow twenty years to readjust the royalties and there will be a royalty for every horse power generated. Moreover, if the companies have any surplus, the Government will compel them to sell the power to local users first at a reasonable rate, and if there is any dispute as to price, it will be settled by the Public Utilities Commission.

The directors of the Shawinigan Water & Power Company have decided to add two units to the plant at Shawinigan Falls, making five altogether. The water wheels will be supplied by the I. P. Morris Company, of Philadelphia, and the generators, of 15,000 kv.a. capacity, by the Canadian Westinghouse Company.

The addition to the No. 1 elevator of the Montreal Harbour Commissioners will involve the practical reconstruction of the electrical plant. Some of this will be removed, and additions will be made which will increase the power required.

Pacific Province Progress

Under the heading "Public Utilities," the following statement occurs in the report for 1912 issued by Mr. F. L. Fellowes, city engineer of Vancouver:

The year 1912 marks the commencement of the Western Canada Power Company's operations within the city limits, and since construction was started a vigorous policy of extension has been adopted. To date 18.65 miles of underground cable have been laid in 11.09 miles of trench, approval having been granted for 36.19 miles of underground cable. All the overhead work has now been constructed, representing a total of 6.45 miles. A very commendable feature of this company's operations is the underground construction that has been adopted throughout the business sections of the city, and it is unfortunate that other companies operating pole lines in these sections cannot be compelled to do the same. With the advent of another company seeking a franchise for steam heat, refrigerator, light and power mains under city streets and lanes, it is becoming imperative that some well defined system be adopted as to location and depth of all underground construction, and any new franchise granted should stipulate explicitly that the method or manner of installing all or any part of such systems must be to the specifications and approval of the city engineer, and in such locations and depth as may be directed by him.

I would recommend that the question of underground construction be taken seriously in hand at once, and an assistant engineer appointed to this branch of the department, to devote his whole time to looking after public utility matters so that a comprehensive scheme can be drawn up covering the exact location and depth of all future ground work. From now on this class of construction is bound to increase rapidly, and it is very necessary to conserve every available inch of space in street and lane allowances, and unless each company has a given location and depth to adhere to, the line of least resistance is invariably taken, which means underground work running in all directions and, in consequence a serious loss of space. I consider this question of underground construction one of the greatest importance. By taking this matter in hand now an untold saving can be effected to the city in later years.

Will Build Twenty Miles This Year

Mr. Wm. McNeil, assistant general manager of the Western Canada Power Company, and chairman of the Burrard, Westminster, Boundary Railway & Navigation Co., Ltd., Vancouver, announced recently that work will be commenced this year on the installation of two additional electrical units at the former company's plant at Stave River Falls, situated about 35 miles east of the city of Vancouver. It is intended to complete the work in about eighteen months. The present installation of two generating units has a normal capacity of 25,000 horse power, and will carry continuously, if required, a 25 per cent. overload. With the installation of the additional electrical units, the company will thus have 50,000 horse power available for distribution. The total possible development at Stave River Falls will then have been completed, but the company will probably later duplicate its plant and output at a point three miles below the falls on Stave River, where the channel narrows and the waters rush through a contracted canyon—an excellent site for power purposes.

The increasing demand for power in the districts served by the company, including the large field in the city of Vancouver, is responsible for the determination to commence work at an early date on the extension of the plant. It is stated that the additional units will be in operation by the time it is necessary for the company to supply power for the operation of the Burrard, Westminster, Boundary Railway & Navigation Company's line between Vancouver and Mission City, along the north bank of the Fraser River. About twenty miles of this line will be built this year, between Stave River Falls and the Pitt River. The work will be started in May, and within two years the entire line of railway between Vancouver and Mission City will be completed. For twelve miles eastward from Stave Falls, the railway will follow the general line of the Dewdney trunk road, thence westerly it will take a more direct route to the Pitt River than is followed by the road. The Burrard, Westminster, Boundary Railway & Navigation Company recently concluded contracts for the transportation of an immense quantity of logs from lands in the vicinity of Stave River, and Stave Lake. The owners of the timber tracts are anxious to commence logging operations on a large scale at an early date, and in order that the movement of the logs may be commenced as soon as possible, steam locomotives will be operated on the road as soon as the rails are laid. Eventually, of course, the railway is to be an electric one, drawing its power from the Stave Falls plant of the Western Canada Power Company. The railway Company will commence electrification of the line as soon as the roadbed has been completed, but it is estimated that two years will elapse before electricity will be the sole motive power in use over the entire stretch between Vancouver and Mission City.

Hon. Thos. Taylor, provincial minister of public works, has announced that work on the construction of the railway and traffic bridge over the Pitt River will be commenced early this summer. This bridge will be used by the railway company, and will be completed by the government in two years' time from date. The railway will cover the rich agricultural district along the north bank of the Fraser River, all of which will eventually become tributary to the Vancouver market.

Full Capacity at Jordan River

During the second week in February the Jordan River plant of the Vancouver Island Power Company was again in operation to its full capacity of 12,000 horse power, the repairs to the generating units which were damaged by lightning last November, having been successfully completed. One of the units was repaired within two weeks of the accident, giving 6,000 horse power, and with the Brentwood Bay and Goldstream power plants in full running order, the company were enabled to generate a sufficient supply of power, though the capacity was taxed to the utmost. The repairs to the second unit were of a more complicated nature, the assistance of the company's experts in Vancouver being found necessary.

The installation of a third unit at the Jordan River plant is now under way, and its power will be available next fall. The addition necessitates the expending of a large sum on enlarging the storage facilities and the pressure line at the power station, and in additions to the present plant, but at the rate at which the demand for power for all purposes has increased in the city of Victoria and adjoining territory, the additional supply will be fully utilized. Since the Jordon River plant was installed, more than one year ago, the company's output of power has increased by more than three hundred per cent.

Good Year for Nelson, B.C.

The city of Nelson according to the annual report of Mr. Herbert P. Thomas, city electrical engineer, has had a very successful year in their light and power department. The revenue has exceeded $62,000 and the actual expenditure, including some $23,000 on capital account, has been about $45,000. The street lighting of the city has been improved by the installation of twenty-four 3-light tungsten standards, ten 4-light clusters and ten carbon lamp clusters. The number of consumers now on the city books is 1,414, an increase of 138 over 1911. During the past year the power load was increased by 85 h.p. making a total connected load of 998 h.p. at the present time.

Until a short time ago all lighting in Nelson was sold on a flat rate, but owing to the fact that consumers did not take the trouble to turn their lamps out even during the day time, it was decided to install meters, and 379 are now in service, including power meters. The difference in load is shown by the fact that the average maximum load carried by the generators during December, 1911, was 1320 h.p., while for December, 1912, with the meters installed and with the added consumers as above noted, the average maximum load was only 1,145 h.p., a decrease of 175 h.p.

The plant from which Nelson derives its light and power is municipally owned. It is a hydro-electric system at Bonnington Falls a few miles out of the city.

Cluster Lighting in Victoria, B.C.

According to the recently issued annual report of City Electrician Hutchinson, of Victoria, the cluster lighting system in that city now covers about eight miles of the downtown section, equipped at a cost of $250,000. In his report the city electrician refers to the policy approved of by the last council for extensions of the cluster lighting system to the residential sections. the owners benefitted to be required to pay for power as well as the differences between the cost of the existing arc lighting system and the cluster lighting system, and recommends that this policy be continued. The arc street lighting system has also been improved by the installation of more lights and a re-arrangement of the main circuits from the power station to James Bay, the Fairfield section, Victoria West, and Spring Ridge, in which districts the growth of the city has been pronounced. Reference is made to the benefit derived by the city from the low rate for power obtained from the Jordan River plant of the Vancouver Island Power Company, and the installation of additional machinery at the city plant to provide for the utilization of this power. The city electrician closes his report by recommending that this year, additional storage room for equipment be provided, together with a motor service truck and the continuation of the work of laying underground conduits to provide for the cable when it is required.

New Sub-Station for Victoria

The British Columbia Electric Railway Company will shortly commence the erection of a power sub-station on Richmond Road in the Oak Bay district, Victoria. The cost of the new station, including the site, is estimated at approximately $40,000. The settlement of that portion of the city and the adjacent municipalities has rendered the substation imperative as to serve that section at present, means the erection of more pole lines, and the addition of a great amount of equipment which encroaches upon the streets between the Store street station and the eastern section. By the erection of the sub-station on Richmond Road, the power lines of sufficient capacity to meet future requirements can be laid in such a manner as to be least inconvenient to the public, and the supply for that section concentrated at the station whence the lines can reach out as required. A more efficient and safer service will thus be given.

The Coquahalla Development

The Hope & District Power, Light & General Development Company, Limited, recently applied for the use of water from the Coquahalla River for power purposes. This river flows in a westerly direction through the Coquahalla Canyon and empties into the Fraser River near Hope. The amount of water for the use of which application has been made is estimated to develop 8,000 horse power. The plans of the company are only partially known at present, but they include the installation of an electric lighting plant for the town of Hope, B.C. Attention has been drawn many times within the last two years to the splendid asset in the water power of the Coquahalla River, which has been so long neglected, and the development of which may mean so much to the town and district. The president of the new company is Mr. A. E. Raab, and his associates include among others Mr. H. V. Dardier, president of the Anfeas Gold Mines, Ltd.

Vancouver Street Lighting

Following is a statement showing the number of extensions made to the street lighting system at Vancouver during 1912:—

Street arc lamps.—The total number of arc lamps in the city at the end of 1912 was 1,669; an addition of 248 lamps since the end of 1911.

Ornamental street lighting.—The total number of ornamental cluster light standards in use at the end of 1912 was 621; of this number 352 were installed during 1912. Ornamental cluster light standards are now installed at the following locations: Granville street, 125; Hastings street, 126; Main street, 88; Pender street, 90; Cordova street, 78; Robson street, 66; Beach avenue, 48; total 621. The following ornamental cluster light standards are under construction. Harris street, 76; Hastings street, 44; Granville street, 40; Main street, 59; total 219.

Contract is Closed

Mr. C. H. Cahan, K.C., president of the Western Canada Power Company, has just returned to Montreal from England, where he has been in negotiation with the directors of the British Columbia Electric Railway Company for the supply of power. A meeting of the directors was held in Montreal, on February 18th, and at its close Mr. Cahan announced that a contract had been made with the B. C. E. R. Company for the sale of a large quantity of electric power to that company on satisfactory terms. The contract commences with a supply of 12,000 horse-power on September 1st next, increasing to a maximum supply of about 40,000 horse-power upon the completion of the Western Canada Power Company's second installation.

New Terminal for B. C. E. R. Co.

The B. C. Electric Railway Company have bought the northeast corner of Pandora avenue and Douglas street, Victoria, B.C., for their new terminals. It is the intention of the company to erect, at an early date, a ten-storey building to house the various departments of the company. The location is in the very heart of the city and splendidly adapted for the company's requirements. In rear of the office building the terminal station for the Saanich and Suburban System will be erected. The cars will reach the building from Douglas street, via Cormorant street, on three tracks, running through the station to Pandora avenue.

Kalso Lighting Contract

The city of Kaslo, B.C., is making a determined effort to secure better terms in its lighting contract with the Kootenay Electric Light Company, and it is said that if negotiations with the company prove unsatisfactory, the city may assume the ownership of its lighting plant. A communication was addressed to the light company recently in which it was pointed out that though the city were buying 4,500 watts at a monthly rate of $97.10, they were willing to pay the same amount for 3,500 watts flowing through tungsten lamps, according to a plan attached to the letter.

Recent Telephone Extensions

To secure the utmost efficiency when the new cable is laid to Vancouver Island, between Point Grey and Nanaimo, the B. C. Telephone Company has decided to run a line up the Saanich Peninsula, using a two-mile submarine cable under Saanich Inlet, and another aerial line between Cobble Hill and Nanaimo. Expenditure on this may run as high as $20,000. A party of B. C. Telephone officials, consisting of Messrs. G. H. Halse, secretary-treasurer; C. F. Bollschweiler, general superintendent of plant; G. McCartney, superintendent of construction, and E. P. Labelle, plant engineer, went over the route early in January, and located a suitable landing place for the cable on the peninsula side of the Inlet. The cable will be 10-pair, 13-gauge, lead covered and armored, two miles in length. The company's line now runs over the Sooke Mountain, but there is danger from interruption on this route owing to the timber and snow. On the other route these dangers practically do not threaten. The line now in use will be maintained as an emergency. While on the trip up the Saanich Peninsula, much development was apparent. This district is going ahead rapidly, and expansion there will be materially assisted by the construction of the tram line by the British Columbia Electric Railway Company. After looking over the Peninsula the party went to Cobble Hill and though no records or maps were obtainable, a good route was selected for the line between that point and the inlet, a distance of three miles.

New Telephone Buildings

Progress is reported by the building department regarding the final plans for the new offices and stores to be erected by the B. C. Telephone Company on Front street, Vancouver. These are now ready, and if approved, work will be started at once so that the building will be ready for occupancy early in the summer. Construction of the new school, adjoining the Fairmont exchange, is proceeding rapidly. The brick walls are all up ready for the roof, and the steel work is in position. It is expected that outside construction will be practically completed about the middle of the present month, and the plastering will be finished the first week in March. Amended plans for the new telephone office on Ferris Road, South Vancouver, are now awaiting approval. This office will be up-to-date in every respect, and will enable the company to take care of that district for some time. The new office at Alberni was completed and ready for the switchboard on January 15th.

Plans are now being prepared for a new head office building for the company, to be erected on Seymour street, Vancouver. The building is to be ten storeys high, and will represent an investment of nearly half a million dollars when equipped. It will house the Seymour exchange, and the present buildings, now badly crowded, will be given over to other purposes. It is expected that the new structure will be ready for occupancy about the beginning of 1914.

Small Towns Well Equipped

Improvements in service made by the B. C. Telephone Company are not confined to the cities and larger towns. During the past few months work has been extensive on the lower mainland and Vancouver Island particularly. Much work has been carried out in Vancouver, North Vancouver, New Westminster, Victoria, Nanaimo and Alberni. To secure the fullest advantage of the increased facilities, new circuits have been strung and new equipment installed throughout the Fraser River and Burrard Inlet districts. The new circuits include two to Ladner, two to Milner, one to Cloverdale, a line to Abbotsford, a new cable across the Pitt River and a new cable to Mission Junction. In practically every one of the smaller exchanges improvements have been made in the way of switchboards. These have been installed at Ladner, Trail, Sydney and Phoenix.

Issuing More Bonds

The Bell Telephone Company propose issuing additional bonds and debentures to the amount of $3,750,000. The outstanding bonds of the company at present amount to $6,399,000 and the paid-up capital to $15,000,000. The company have authority to issue bonds up to 75 per cent. of the paid-up capital. The company will add two and a half storeys to their present head office on Hospital street, Montreal, making eight and a half storeys in all. The work is estimated to cost $52,000. The addition will be constructed of brick, and the floors of maple. The roof is to be felt and gravel. Mr. W. J. Carmichael is the architect.

Alberta's Telephones

The telephone department of the provincial government of Alberta has just issued a report showing a net profit for the past year of $62,283, and a total net profit for the past six years during which the system has been operated by the province of $407,592. Since the province took over the telephone system it has grown from 1,859 wire miles connecting 70 offices to 6,698 miles connecting 234 offices.

3,600 Ft. Cable

The Segur Oil Refineries is laying a cable 3,600 feet long from Barnet to its barrel manufacturing plant on the north side of Burrard Inlet. The object is to establish telephone communication. Residents of the vicinity will have the advantage of connecting with the cable.

Running Waters in Quebec Prov.

By a recent Act of the Quebec legislature, a commission was appointed for the management of running waters in Quebec, consisting of three commissioners who are experts in hydrography and the management of forests. The committee has since occupied itself with the preparation of a report on the regulation of the waters of the St. Maurice River by the construction of storage dams, and has now issued a report to the legislature under date November, 1912, copy of which is just to hand. The members of the commission are S. N. Parent, chairman; Ernest Belanger, and Wm. I. Bishop. The following extracts with reference to the water resources of the Province of Quebec and to the general value of regulation by means of storage reservoirs are of more than ordinary interest.

Water Resources

The Province of Quebec is particularly well favored from the standpoint of water-powers. On the strength of calculations made under its direction, the Conservation Commission of Canada estimates the total available powers in our province at 6,000,000 horse-power. We think this estimate is far too low and nobody who knows the situation will be astonished at this because on many occasions there has been found a total lack of accurate official data on the subject, while those that exist are insufficient.

In its report for 1911 the Conservation Commission of Canada gives the total amount of power developed in this province at 300,153 horse-power. The total power developed at this date can be estimated, without any exaggeration, at 400,000 h.p., taking into account inaccuracies in data available, and later developments. But above all our province should be given its due share of the power developed on the Ottawa River, owing to the latter's geographical position, which comes as an addition to the first figures mentioned. This enormous power represents a very considerable asset which cannot but increase in value as the years go by.

The era of White Coal may be said to be merely at its inception in our country. This is an economic fact the far-reaching consequences whereof can already be seen. Legislators cannot therefore be indifferent on the subject. It is exceedingly important to prepare for the new conditions that will result. The advance of progress is more rapid and is surer when the ways have been foreseen and prepared. The government has fully realized that it is necessary to lay the foundation of a broad and farseeing policy of conservation. By this is meant, with regard to natural resources, not only their protection, but also their judicious utilization in the public interest, one as well as the other.

Such tremendous strides have been made, within the past ten years, in the development of hydro-electric power and its transmission that its field of action has been increased tenfold. And the day is beyond a doubt not very distant when water-powers now deemed practically inaccessible, will come into demand to be used.

New electro-chemical and electro-metallurgic processes are constantly being brought to light and their commercial application calls for ever increasing amounts of power. The pulp and paper industry, which as everybody knows, is one of the largest power consumers, is constantly increasing its demand for power.

Taking all these facts into account, it clearly appears that our province, however great may be the wealth of its hydraulic resources, must not only exercise the greatest care and be sparing of such resources, but must also seek to improve those already developed in order to obtain the greatest possible benefit from them.

Control of Stream Flow. Its Necessity

In the majority of the rivers of Quebec, there is an enormous variation between the maximum and minimum flow under ordinary conditions. Let us consider the result of such fluctuations. Under certain given conditions when a regular flow throughout the year would give 8,000 horse-power continuously, the result of these considerable variations under ordinary natural circumstances, is that the real capacity drops to 2,000 hores-power. On the other hand, at high water, it reaches 200,000 horse-power, but only for short periods. During our long and cold winters the usual sources from which our rivers are fed, are dried up by frost. Hence the flow is lessened to a degree equalled only, under precisely opposite conditions, in semi-tropical countries where heat and drought cause the waters to be at their lowest in summer.

In our case, water is at its lowest about the middle of winter. All that season also, the water at the foot of falls and cascades wherever it is smooth, becomes filled to a considerable extent with crushed ice (frazil) or anchor ice, causing very serious drawbacks, in many instances complete stoppage of the works. Such drawbacks would be avoided if the flow of water were increased so that a portion of it could be used to force away that ice. But, under present conditions, the period of extreme low water occurs precisely in winter, where a sufficient volume of water is not usually available to allow of the necessary quantity being withdrawn without completely stopping the works. Such irregularity in the flow of our rivers is thus practically general. There is, however, a brilliant exception in the case of our incomparable River St. Lawrence. The proportion of the maximum to the minimum flow is in fact two to one. It should be observed, however, that its course is practically the most stable of all the rivers of the world.

Deforestation and Stream Flow

Some claim that excessive deforestation has no prejudicial effect on the conditions of our rivers. This opinion is shared by a certain number of authorities on the subject. It would seem, however, that in any case the preponderant majority, holds a contrary opinion. It seems beyond a doubt, and a fact fully proved by experience, that the action of the forest has a very marked effect as regards freshets, the regulation of the flow and the conditions of rivers. But the effects of deforestation are greater in mountainous regions. As a general rule, however, it is admitted that deforestation to a considerable extent at the sources of streams causes rain or surface water to run off more rapidly, increasing freshets and making them more damaging, and produces a greater corresponding decrease in the flow at the low water stage than would occur under natural conditions.

In any case, an interesting fact may be noted here. It has been found that, in some rivers on the north shore of the St. Lawrence where there has been little or no deforestation, the flow is not exempt from variations. Thus it will fall as low as ¼, i.e., 0.25 cubic foot per second per square mile of the water basin and rise to eighty times that volume at high water. This has been noticed on the Malbaie River. It is evident, therefore, that the necessity of regulating the flow is ever present even under conditions which theoretically seem the best.

Possibilities of Water Storage

The great irregularity in the flow of rivers from whatever cause, is therefore an established phenomenon. But there is also a means of remedying it. Nature has provided for it by enabling us to hold back the highest or surplus water which through lack of proper distribution, is lost in the sea. Such holding back of the waters is effected by means of storage dams and the operation is also known by the name of storage. Here again our province is exceptionally favored through its physical conformation.

The Laurentian watershed north of the St. Lawrence, may be said to present an uninterrupted series of lakes, the distinguishing features whereof are rocky and steep shores and narrow outlets. Such are precisely the conditions required for making storage dams and for holding back the water at a comparatively small expense. It seems, therefore, therefore, that, with very few exceptions, the rivers of the Province of Quebec offer great facilities for regulating works which would assure the stability of their flow and make it practically equal at all seasons of the year.

Flood Prevention

River flow regulation by means of storage dams would put an end to the devastating floods which occur periodically in the valleys of our rivers, damaging highways, railways, bridges and other works or structures, and doing no less harm to farming lands through erosion of the soil and the layers of silt and sand deposited on them.

Lumbering Industry

This industry will also directly benefit by the elimination of excessive freshets; when these occur, the booms are broken, causing very heavy losses of timber. With a regulated flow such accidents would no longer be feared. Moreover, the log driving could begin earlier and be carried on later in the season. At the same time the logs would not be held back by grounding on the sand bars and banks, as now happens every season when the level of the water falls.

Water Powers

We have seen that, owing to the excessive variations between the levels of high and low water, there are very considerable differences in the capacity of such powers. By increasing the minimum flow their available capacity would become several times greater and would remain so permanently. As to the powers already utilized, it will readily be seen that the direct benefits of such increase would attain a high figure. Future enterprises could be organized in such manner as to benefit by the greatest minimum flow which would be assured. The province would be the first to benefit by it directly through the increased revenue it would derive from water-power concessions and indirectly afterwards through the growth in population resulting from the creation of extensive industries. There are a great many small rivers whose present flow at low water is too weak to make it worth while attempting to utilize their water-powers. Such flow at low water might, however, be increased sufficiently for the establishment of works on a profitable footing. Moreover, the effect of regulating the flow would be to lower the figure of the unit on which one usually relies for utilizing water-powers, the capital or initial cost of the undertaking.

Thus, the same works, dams, etc., required for utilizing a stream with its present minimum flow and corresponding power, or even works on a smaller scale would suffice to produce several times such minimum power with a stream whose flow would be even, that is, regulated. Let us take an instance. We will suppose that a dam is to be erected on a river of sufficient strength to resist exceedingly high freshets, and that its cost would be about $50,000. If the capacity produced with the present weak flow is 2,000 horse-power, the expense of making the dam would therefore be $25 per horse-power. On the other hand, with a regular flow, we will say that a capacity of 5,000 horse-power could be produced. The initial outlay of the undertaking would then be only $10 per horse-power.

Navigation

Here again appreciable advantages would be derived from the regulation of rivers and streams. It would aid navigation by putting an end to the formation of sand bars caused by the erosion of the banks through freshets, and assure a sufficient depth of water throughout the season.

Conclusions

The report contains the results of the investigations of the committee with special reference to the conditions existing on the St. Maurice and its tributaries, and strongly advises the government to undertake the expense of creating storage reservoirs. The falls on the St. Maurice River between the La Loutre Falls and the St. Lawrence River number 34, ranging in head from 136 feet down, and having a total of 869 feet of fall. As showing the advantages to be gained from the installation of storage dams, it is calculated that the approximate horse power available under the present minimum flow counting eighty per cent. efficiency of machines, totals 306,048 h.p. This could be increased by the building of dams above the falls by 55,272 h.p., making a total of 361,320 h.p. Under conditions of proper storage, however, the approximate power available, counting 80 per cent. efficiency as before, is placed at 1,055,652, an increase of practically 200 per cent.

Summing up the results of their investigations, the Commission reaches the following conclusions:—

(a) There is no further need to demonstrate the exceptional importance attached to the conservation of waters, and the benefits to be derived from the measures for regulating the flow of our rivers. The work of assuring the permanence of our water-powers is of paramount importance. But it is likewise possible to greatly increase their value, capacity and efficiency. And this source of energy, which enlightened foresight can render inexhaustible and manageable, is a capital which we have every interest in keeping intact, and making fruitful, all the more so that the price of coal is rising rapidly and there is none in the territory of our province.

(b) The storage of the waters of the Upper St. Maurice could be effected by means of a storage dam erected near the rapids of La Loutre, whose capacity would be 160 billion cubic feet and which would cost about $1,300,000—a project which presents itself under absolutely practical and advantageous conditions—and plans, specifications, etc., should be prepared by one or more competent engineers for calling for tenders and the execution of the work.

(c) The carrying out of the plan would add at least 600,000 horse-power to the river's capacity and to the hydraulic wealth of the province at the slight cost of $2.25 per horse power.

(d) At the same time we should have an even flow and the elimination of disastrous freshets to the great advantage of industry, navigation and the driving of logs on that river.

(e) The regulation of the St. Maurice is of urgent necessity; the principal interested parties—the grantees, mill-owners and others who use its waters—are eagerly asking for it.

(f) Three periods of low water will elapse between the moment when the works will be begun and the time when their effects will be felt. Each period means a loss of several hundred thousands of dollars.

(g) This project, in its entirety, is one of the greatest of its kind in the whole world. And yet, as compared with other similar works, the cost of erecting the barrage would amount to but a small proportion of the cost of the others owing to the immense superiority of its volume of storage.

(h) As regards the monetary side of the project, the Commission sees a way to provide for it itself without its being necessary to have recourse to the Provincial Treasury for the execution of the works.

(i) The fixed annual charges and those of maintenance would be modest, if not trifling, compared with the benefits to be derived. It is certain that from the very outset more can be done than merely make the general charges and the revenues balance. In fact there is reason to foresee that, in the near future, the province would derive a considerable and sure yearly revenue from it.

(j) Indirectly, the province would have an additional increase in its revenues owing to the economic and industrial development of that region. For all these reasons of public utility and economic interest the Commission on Running Waters is of opinion and recommends that the plan of works elaborated in all its details in this report for the regulation of the waters of the St. Maurice, be carried out as soon as possible.

To that end, the Commission respectfully submits that it would be expedient to grant it further powers in order to enable it to diligently and effectively pursue the realization of that great project, which will mark an era for our province in the growth of its wealth and well-being as it tends to enhance the value of its natural resources and to their more thorough utilization.

Saskatoon Will Extend New Railway

The city of Saskatoon will expend $100,000 during the year in extensions to their new railway system. This will include double tracking and the laying of new switches as well as additions to the rolling stock which it is considered will be necessary if the service is to be kept up to the desired standard. It is also expected a new turbo-generator will be required of probably 2000 kw. capacity. This will almost double the present capacity which is not quite 3000 kw. It has not been decided whether the new rolling stock will be double or single truck, the decision hingeing largely on whether the bridge over the Saskatchewan river is sufficiently strong to carry the double truck cars. It is understood a rate of 2.75c. per kw. hour will be charged the street railway department.

Value of Storage Batteries in Central Stations

Figures Based on Actual Results of Two Years' Operations of a 12,000 Ampere-hour Battery in Central Station Supply

By F. H. Whysall, A.M.I.E.E.*

This paper is for the most part based on the results obtained over two complete years' working of the 12,000 ampere-hour battery installed at the Manchester Corporation Electricity Works, Dickinson street, in March, 1910. This battery was at the time of its installation the largest ever constructed and has a maximum discharge capacity of over 15,000 amperes.

In times gone by, this Institution has dealt repeatedly with the question of secondary batteries; but most of such papers have been concerned with the construction or behaviour of batteries without special reference to the particular object for which they may have been installed. It will readily be realized that before so large a battery as that at the Manchester Corporation Electricity Works, Dickinson street, could be recommended, the saving to be effected by its use had to be most thoroughly and carefully examined. Not only had the initial cost of the battery to be compared with that of an alternative increase of generating plant, but the method of using a battery, whether on lighting or traction and over what periods, had to be decided.

It is now two years since the battery was installed, and the object of the present paper is to show to what extent the predictions as to its use have been fulfilled, and what relief has been obtained in the cost per unit supplied. The author thinks it will be admitted that the battery has thoroughly justified itself during this period, and the figures in this paper should tend to encourage other engineers of central stations to go and do likewise.

Although details of the battery arrangements have already been published, it is necessary, in order that this paper may be complete and clear, to put down for reference the more important data of the equipment.

Technical Description of the Battery

The battery consists of 210 cells, each cell containing 38 positive plates and 39 negative plates of the following dimensions:—

Positive plates, 20¾ in. wide × 29 in. deep × 0.4 in. thick.

Negative plates, 20¾ in. wide × 29 in. deep × 0.31 in. thick.

The positive plates are of the Plante formation, cast in one piece, but the negative plates are of the improved box type composed of half grids securely riveted together, the spaces between them being filled with active material. Specially impregnated wooden separators are employed between adjacent plates, and a free space of 8 in. is left at the bottom of the cell for the accumulation of deposit.

The cell boxes are of pitch-pine lined with lead, the outside dimensions of each box being as follows:—

Length, 6 ft. 1½ in.; width, 2 ft. 2½ in.; height, 3 ft. 4½ in.

The following are the guaranteed performances of the cells:—

Maximum discharge rate, 15,000 amperes.
One-hour discharge rate, 8,400 amperes (3,000 kw.).
Charging rate, 4,100 amperes.
Maximum charging rate, 6,500 amperes.
Maximum charging voltage, 2.75 volts per cell.
Ampere-hour efficiency, 90 per cent.
Watt-hour efficiency, 66 per cent. at 1-hour rate (8,400 amperes).
Watt-hour efficiency, 75 per cent. at 3-hour rate (3,900 amperes).
Final voltage per cell, 1.67 volts at 1-hour rate.
Final voltage per cell, 1.78 volts at 3-hour rate.
Weight of each cell and acid complete, 2 tons 19 cwt.
Weight complete battery, 620 tons.
Floor space occupied, 5,966 sq. ft.

Regulating Cells, Boosters, and Methods of Charging and Discharging

The chief advantage attached to the use of regulating cells is that the output of the battery is not limited by the capacity of the boosting plant; and in cases where a battery is used as standby, regulating cells have distinct advantages over boosters. On the other hand, with large batteries the switchgear for regulating cells becomes, with its connections, a very cumbersome piece of apparatus, and the usual practice is to have booster regulators, automatic or hand-regulated, except for standby batteries and batteries of small size. Traction batteries always have automatic boosters, and in all cases where boosters are used it should be possible to parallel the battery without boosters in circuit under breakdown conditions.

The reversible booster enables all the cells to be used equally, and avoids the necessity of cutting out regulating cells when fully charged.

With larger batteries the cost of reversible booster and battery is less than for battery with regulating cells plus charging booster, which is necessary in any case. The efficiency in both cases is about the same.

In the United States of America batteries are frequently installed large enough to supply the whole load of the system for a short time in case of a total failure of the generating plant; but this is not usual in this country. In such cases regulation by regulating cells is adopted, and in extreme emergencies the battery can be called upon to give an enormous discharge far exceeding its normal rating. It is important that the discharge should not be limited by the carrying capacity of the booster, a regulating switch can be overloaded to a much greater extent without any serious injury.

Further, when batteries are used only in case of breakdown, if a reversible booster were used either the booster would have to run continuously with no load, or else when a sudden breakdown occurred the battery would not be immediately available. Where a battery is put in to reduce fluctuations in the load on the generators it is also looked upon as a standby, but this is not its principal function; further, at times of heavy load the reversible booster would in any case be running.

The chief duty of the Dickinson street battery is to take 3,000 kw. off the lighting peak. It is also looked upon as a standby. But its chief duty is load-levelling; and it was therefore decided to have three hand-regulated reversible boosters, as shown in Diagram A, Fig. 1, and to run them in parallel at times of maximum discharge. At other times, one or two would be used as required. It may be noted, however, that such importance is attached to the question of overload in emergency that it is the universal custom on the Continent to use regulating cells in all central-station batteries.

In this country, the first large batteries with which reversible boosters were used were those installed by the Charing Cross, West End and City Electricity Supply Company some twelve years ago; in fact, these were the first important central-station batteries installed for taking the peak load. In this case the transmission is by high tension, and a battery unit giving about 400 to 500 kw. is installed in each of the seven sub-stations. Since that time the number of important batteries has been steadily increasing; but they are all used in the same way, with one exception—where a combination of regulating cells and reversible booster has been adopted so that the battery can be discharged and regulated to a limited extent, even when the booster is not running.

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*Presented before the I.E.E.

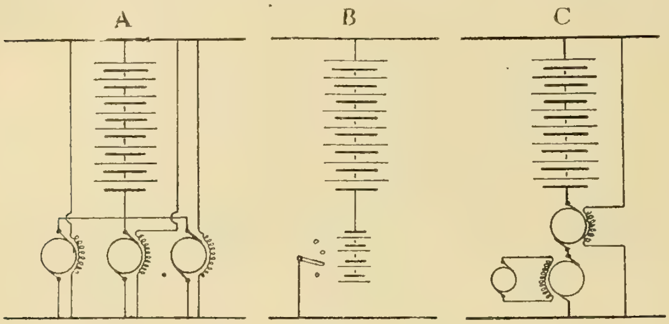

Fig 1

At Dickinson street the battery was also arranged for use on the traction supply; and for this duty a series-parallel arrangement was made of an extra busbar and change-over switches for one booster.

Short-circuiting switches are provided for all booster busbars, these switches being used to cut out the boosters under breakdown conditions, or when boosters are not required, for instance on Sundays, when the battery does the whole of the lighting load for the greater portion of the day.

The lighting load is much bigger than the traction load, and for some time it has been found more economical for that reason to confine the use of the battery to the lighting load. The boosters worked quite satisfactorily on traction with automatic exciter regulation as shown in diagram C, Fig. 1, but the saving effected in works costs was not so great as when the battery was used on lighting alone.

It was originally intended to charge the battery on traction, thereby providing a constant load for one 1,800 kw. traction generator, and enabling it to do the whole of the traction load for the city area by discharging over the traction peaks; also to change the battery over to lighting for the lighting peak. It was found that at certain times of the year the traction and lighting peaks were coincident, and for this and other reasons stated, its use is now confined to lighting. When the traction and lighting peaks are not coincident the battery now virtually does both, because it is made to take up the duty of the set which is changed over from the lighting system to traction to supply the traction peak load.

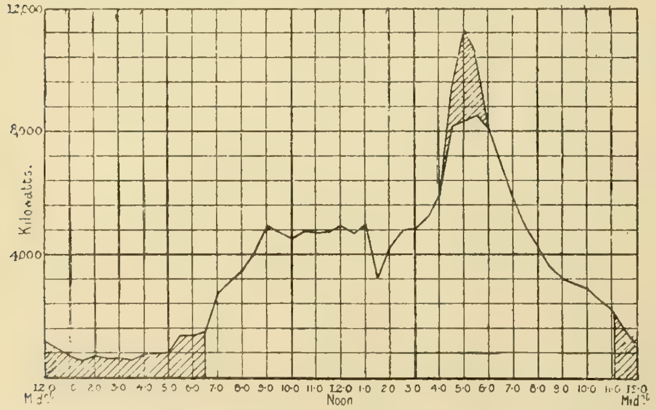

Fig. 2.—Load curve (without battery). The proposed use of a battery is shown by the "hatched" portions of the curve. Load factor = 32%.

The boosters are of the Turnbull-McLeod automatic reversible type, and were manufactured by the Lancaster Dynamo and Motor Company. They have equalizing rings to every turn of the armature windings, on account of the heavy circulating currents, and the yokes of the boosters are laminated. Each booster is capable of a maximum boost of 5,600 amperes at 80 volts for a few minutes.

The switchgear consists of 10 panels:—one main battery panel; three booster generator panels, 1, 2, and 3; three booster motor panels; one diverter panel; one booster short-circuiting panel; and one exciter panel.

Two substantial circuit-breakers are inserted in the main cables as close as possible to the battery house. These circuit-breakers are of the magnetic blow-out type, and are capable of carrying 15,000 amperes continuously. Each is enclosed in a separate concrete cubicle so as entirely to shield it from all other parts of the station, and each is electrically and independently operated from the switchboard by means of solenoids.

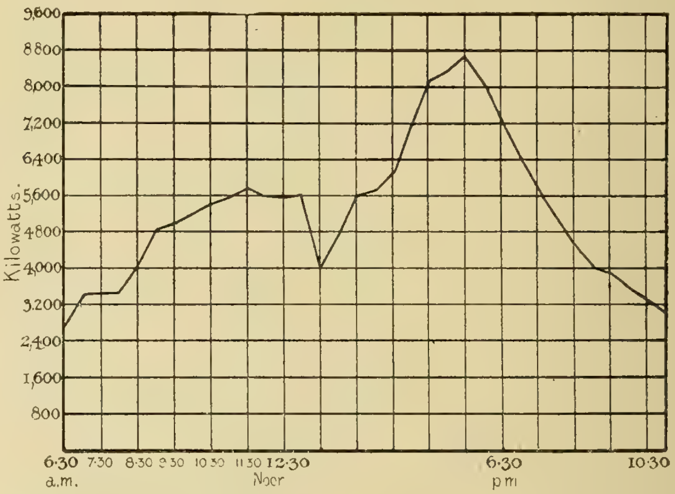

Fig. 3.—Load curve (with battery in use). This curve shows the load on the steam plant. Station load factor = 43.5%.

The circuit-breakers are non-automatic, and are provided with a suitable controller to show by means of signal lamps on the operating panels whether the circuit-breaker is closed or open. The large circuit-breakers on the main switchboard are of a similar type, but mechanically operated from the front of the panels. The circuit-breakers themselves, however, are also enclosed in concrete cubicles. The switchboard circuit-breakers are automatic.

The busbars and connections are carried on a very substantial iron framework at the back of the main board; and here, again, the lay-out has been designed with the object of separating the various busbars by enclosing each in a concrete trough. Busbars of aluminium have been employed throughout.

The main 15,000-ampere change-over switches are constructed of a number of parallel strips clamped together with suitable distance-pieces between, and these interleave with contacts of similar construction. Bolts pass through both contacts, and these can be tightened up when the switch is closed, making excellent contact.

Field for Economies in Central-Station Practice

The improvement effected in the load factor of steam plant really covers everything; but a list of items under this head may be given in detail as follows:—

(a) Saving in standby boilers required: Equivalent to 1-hour rating of battery, owing to extra time available to raise steam, and owing to possibility of applying load gradually.

(b) Saving in capital expenditure, and corresponding annual charges thereon.

(c) Saving in wages of running staff.

(d) Saving in cost of peak-load units.

(e) Saving due to "buffering," i.e., load-levelling, enabling all units to run at their most economical load.

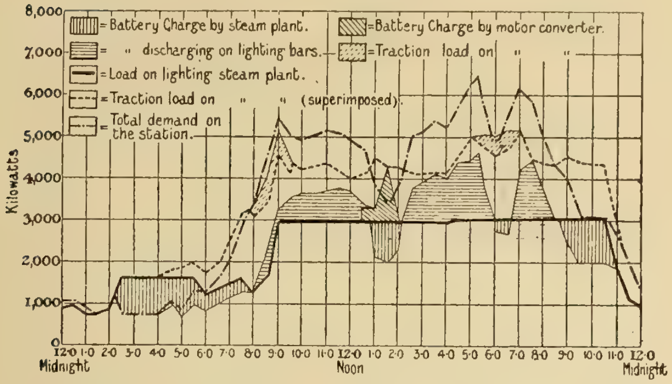

Fig. 4.—Summer load curve. Load factor on steam plant = 67.5%; on max. demand = 54.4%; improvement in load factor = 13.1%.

The value of all these items can be variously ascertained as detailed in the following text, and usefully checked against each other. It will also be seen how engineers may safely estimate the possible saving to be expected of any proposed battery installation.

In Fig. 2 is shown a typical winter-load curve at the time of the installation of the Dickinson street battery, the hatched portion of the curve representing the duty proposed. Fig. 3 shows the expected resultant load curve for steam plant with battery installed.

The load factor in Fig. 2 works out at 32 per cent., and is improved to 43.5 per cent. in Fig. 3. In Figs. 4 and 5 we have typical summer and winter-load curves since the installation of the battery, and it will be noted that the load factors obtained are actually much greater than those anticipated, and are respectively 67.5 per cent. and 49.1 per cent.

In Fig. 6 a chart is given showing the effect of load factor on coal consumption and works cost at Dickinson street and Bloom street works. This chart has been plotted from actual results obtained over a period of eight years, from 1904 to date, and checked by over 100 monthly observations. This process has eliminated very largely any irregularities which might have occurred in the curve due to abnormal conditions apart from the effect of load factor.

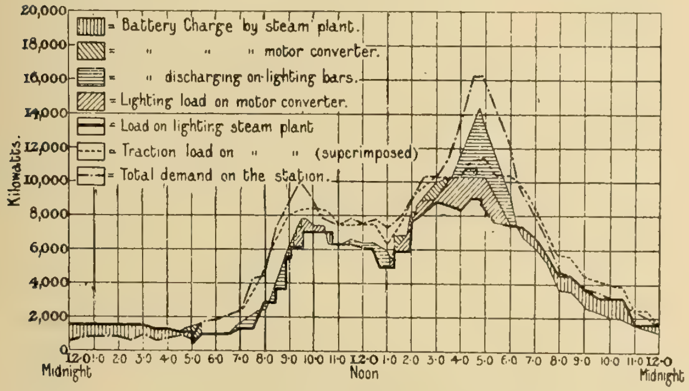

Fig. 5.—Winter load curve. Load factor on steam plant = 49.1%; on max. demand = 34.4%; improvement in load factor = 14.7%.

Dickinson street is now considered an old station, and the largest units at Dickinson street and Bloom street stations are of not more than 1,800 kw. capacity. Attention should be drawn to the fact that the observed coal consumption per unit—of the combined stations—has been down to the low figure shown on the chart. The lowest figure for a monthly observation per unit generated since the installation of the battery is 2.66 lb., and per unit sent out 2.79 lb., the difference being accounted for by units used at the Works and units lost in the battery. The commercial efficiency of the battery was for the first year 70.6 per cent., and for the second year 71.1 per cent.

It is quite unfair to consider a battery capable of saving only the standby represented by its 1-hour rating capacity. In the storm-load chart, Fig. 7, the maximum demand (ignoring traction) was 44.5 per cent. greater than the boiler capacity at the commencement of the darkness; and the battery was able to take care of the rising load as shown, ahead of the extra boilers which had to be got into commission. Without the battery it would have been impossible to get these extra boilers up in time. In other words, it would have been impossible to keep steam, and would have meant practically a total failure of supply unless some portion of the load could have been cut off. What might be described as the elasticity of the system due to the battery makes the question of boiler standby much easier, and less boiler plant is required to meet a given load when such load can be put on gradually.

It is possible to get up 20 boilers in the same time as one, given the necessary men, and what happens in practice is this: When it is seen that extra boilers will be required they are lighted up, and the battery is eased by the running plant until the steam pressure begins to fall. The battery is then called upon to supply the rising load until the extra boilers are steaming. This process may be repeated and other boilers got away, the constant effort of the engineers-in-charge under these circumstances being to get the battery off discharge and to keep it fully charged in reserve to meet the final peak of the load.

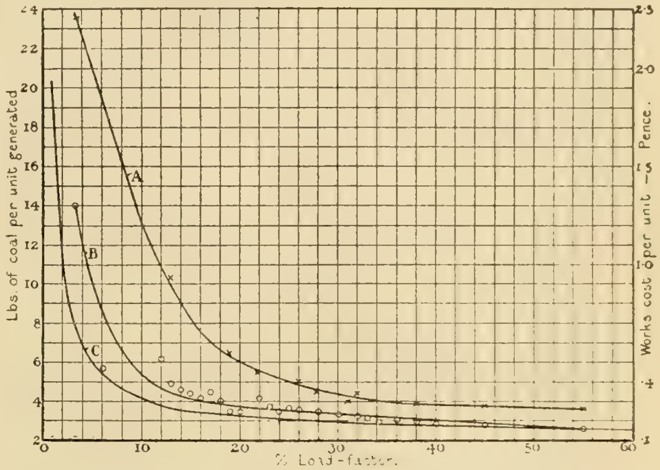

Fig. 6,—Curve A: Works cost per unit generated in pence. Curve B: Pounds of coal per unit generated (from actual observation). Curve C: Pounds of coal per unit generated (by formula).

Capital Cost

The increased use of large batteries in central stations during the last few years has been chiefly due to reduction in first cost owing to improvements in design, i.e., a greater percentage of lead employed is active material; for instance, positive plates have probably two or three times the surface of plates of the same weight made twenty years ago. There is also a reduction in capital cost of manufacture, principally in the formation, the present rapid processes taking only a few days, instead of many weeks, as formerly. Other improvements in manufacture are the use of better methods and tools, in keeping with general industrial progress. There is also a reduction in cost of upkeep and improved reliability; but these come under another heading.

When the Dickinson street battery was proposed, the estimated comparison of capital costs was as follows:—

The hatched portion of Fig. 2, previously mentioned, shows the portion of load which it was thought desirable to transfer from the generating plant to the battery, representing the peak load on a two-hour base, or all load of less than 8 per cent. daily load factor. By measuring the mean area of this hatched portion, we arrived at the "units of output," e.g., on the curve shown the figure is 3,000 kilowatt-hours, equivalent to about 7,000 amperes for one hour. With this datum as a basis, it was easy to estimate the size of battery required. Thus:—

Rate	Output	Equivalent in Amperes
1 hour	3,000 kw.	8,400
2 hours	2,000 ,,	5,000
3 hours	1,500 ,,	4,000
Emergency ½ hour	4,500 ,,	11,500
5 minutes	6,000 ,,	15,000

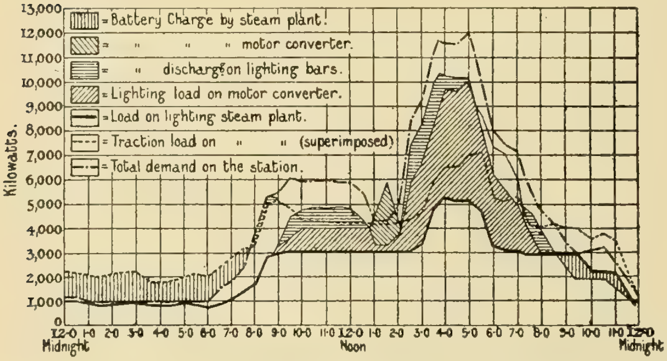

Fig. 7—Storm load curve. Load factor on steam plant=55.0%; on max. demand=32,6%; improvement in load factor=22.4%.

Capital Cost of Generating Plant for 3,000 kw.

3,000-kw. steam plant at Stuart street (excluding buildings but including all else)	£36,000
High-tension cables for 3,000 kw.	5,000
3,000 kw. sub-station at Dickinson street ..	10,000
Total	£51,000

3,000 kw. battery plant at Dickinson street (at 1-hour rate of discharge, and including boosters and switchgear)	£18,000
Buildings	2,000
Total	£20,000

Difference in capital expenditure: £51,000—£20,000=£31,000.

Interest and Sinking Fund

Steam plant: £51,000 to be repaid in, say twenty years:—

Interest ... ... 3½ per cent.
Sinking Fund . 3¾ ,, ,,

7¼ per cent. = £3,698

Battery: £20,000 to be repaid in, say, ten years:—

Interest ... ... 3½ per cent.
Sinking Fund . 8¾ ,, ,,

12¼ per cent. = £2,450

Difference in favour of battery ... £1,248

The actual costs came out as follows, using the same figures for steam plant for Stuart street, high-tension cables, and sub-station as before.

Actual Cost of Battery Plant, Dickinson Street

3,000 kw. battery at 1-hour rate of discharge, including boosters and switchgear.

	£	Loan Period
Storage battery	15,034	7 years
3-motor booster combination ...	2,776	15 ,,
Switchgear	1,757	15 ,,
Buildings	2,000	20 ,,
Total	£21,567	

Estimated steam plant expenditure, as above	51,000
Actual cost of battery plant	21,567
Difference in capital expenditure	£29,433

Difference in Interest and Sinking Fund

Steam plant: £51,000 to be repaid in, say, twenty years:—
£3,698 (as above)

£21,567 to be repaid in ten years years:—

Interest ... ... 3½ per cent.
Sinking Fund . 8¾ ,, ,,

12½ per cent. = £2,642

Saving in capital charges per annum in favor of battery £1,056

Comparison of Cost Per Kilowatt of Capacity

	Estimated	Actual
Generating plant	£17 0 0	£16 16 6
Battery	6 13 4	7 3 9

In these days of turbo-driven units, the capital cost might be taken at a lower figure.

Below are given estimated costs by Mr. J. F. C. Snell in his book on "Power House Design."

Lay-out of Proposed 120,000-kw. Power House at Barking Creek for Bulk Supply to the County of London

Rated output of Power House, 120,00 kw.; Overload, 150,000 kw.

	Capital Cost	Cost per Kilowatt. Rated	Overload
	£	£	£
Land	50,000	0.41	0.33
Buildings	344,000	2.87	2.30
River work and pier	102,000	0.85	0.68
Coal and ash plant	59,000	0.49	0.40
Boilers and economizers	199,000	1.66	1.33
Pipework and pump	105,000	0.88	0.70
Turbo-generator and condenser	430,000	3.58	2.86
Switchgear, etc.	67,000	0.56	0.44
Engineering expenses and contingencies	115,200	0.96	0.77
Total	1,471,200	12.26	9.81

General

Average cost of power house buildings in large cities, £6 11s per kilowatt.

Average cost of power house building in smaller provincial towns, £3 5s to £6 per kilowatt.

Average cost for larger power houses outside cities, £2 5s to £3 per kilowatt.

Generally speaking, the cost of plain substantial buildings may be reckoned for estimating purposes approximately as follows:—

£
5.00 per kw. for 2,500 kw. installed.
4.00 per kw. for 5,000 kw. installed.

2.75 per kw. for 25,000 kw. installed.
3.25 per kw. for 10,000 kw. installed.
2.50 per kw. for 50,000 kw. installed.
2.33 per kw. for 100,000 kw. installed.

Costs compiled from the latest actual figures available are estimated by the author as follows:—

	Total Cost per kw. £	s.	d.
Land	0	5	6
All buildings (including offices)	3	13	0
Land for railway, railway complete and locomotive	1	9	0
Coal and ash plant	0	4	0
Marine boilers with superheaters, including economizers, coal and ash chutes, scraper and stoker driving	2	13	0
Foundations and flues for marine boilers	0	9	0
High pressure steel pipes and covering, including valves. (Main range not included)	0	2	6
Turbo-alternator and condensing plant, pipework for condensing plant and motor-driven fans ...	3	5	6
Foundations for turbo-alternator and air ducts ...	0	4	0
Pipework for turbo-alternator, including circulating water pipes, atmospheric exhaust pipes and valves	0	5	0
Natural draught cooling towers	0	13	0
Foundations for cooling towers	0	5	0
High-tension cable	1	8	0
Converting plant, including switchgear	2	0	0
Total	£16	16	6

Total plant installed ... ... 56,500 kw.

It should be noted that Mr. Snell's figure of £12.26 per kilowatt does not include items in the author's estimate amounting to £5 4s., which would bring up the cost per kilowatt on his estimates to £17.46.

It would seem, therefore, that for peak-load duty of two hours (which averages out at the 1-hour rate of discharge for the battery) the cost per kilowatt can be safely estimated at £17, which leaves a margin of £9 16s 3d in favor of the battery.

Running Costs

It is necessary when considering the cost of generation of peak-load to take into consideration the fact that the most uneconomical units are reserved for this duty, and quite rightly so, also that these peak-load sets will not be run at their most economical load; consequently the steam consumption will be high. Bare fuel cost per 1,000 kw. standby for this peak-load duty the author has estimated at £7 per week, or reckoning five days per week, £1 8s per day. This latter charge becomes in the case of a 3,000-kw. battery £4 4s per day for the bare 1-hour rating of the battery. But we have seen previously, when considering the effect of the battery on load factor, that it is unfair to credit the battery with standby savings on its bare capacity only; and in Fig. 7, showing the storm-load curve, it is demonstrated that the battery saved standby to the extent of 44.5 per cent. on the total boilers under steam at the beginning of the day, also that more boilers are necessary to meet sudden demands that can comfortably cope with an equivalent load applied gradually. We may safely assume, then, that on this occasion a 3,000-kw. battery saved standby for its own capacity plus 44.5 per cent. of the boiler capacity prior to the storm, which was 7,200 kw. On this, 44.5 per cent. is 3,200 kw. Calculating at the same rate without allowing anything for the increased price of coal, we see that our 3,000-kw. battery at this time of the year, say, the five summer months from March 31st to September 1st, is equal to steam standby at the rate of £8 8s. per day. Reckoning on the basis of five days per week gives £924. Adding £630 to this on account of the standby saving for its own capacity for the other seven months, we have a yearly standby saving of £1,554.

Below are some observations at the city stations in corroboration of the author's estimate of standby charges over some months when steam standby had to be maintained. These figures were obtained by comparing the corresponding periods of the year previous when standby was not maintained.

Month	Tons of Coal	Cost £	Standby kw.	Cost per Week per 1,000 kw. £	s.
April, 1911	488	255	8,000	8	0
May, 1911	203	105	5,000	5	5
June, 1911	388	200	5,000	10	0
July, 1911	504	263	8,000	8	0

It must be admitted that it is only fair to charge the battery with bare fuel costs corresponding to the input, because there is an actual saving on running fixed charges on the station when a battery is put in. The author supports this statement by saying that at Dickinson street there are now twenty-two fewer men for an increased demand since the installation of the battery. Comparing bare fuel cost per unit generated, and crediting the battery with a commercial efficiency of 70 per cent., we get a cost per unit (reckoning 2.5 lb. of coal per unit at 12s 5d per ton) of 0.237d. against a cost of 1.55d. taken from the actual results shown on the load-factor curve for 8 per cent. load factor. The peak-load units discharged by the battery since its installation, calculated at the rate of five complete discharges per week—March 31st, 1910, to March 31st, 1912—are 1,560,000, and represent an annual saving of £8,534. This takes no account of the morning discharges and load-levelling duty during the rest of the day, commonly called "buffering," whereby each set on load is kept running at its most economical output, and sets do not need switching in and out to meet the vagaries of the demand. This can also be estimated from the load-factor chart.

The improvement in load factor on the units generated, observed monthly over two years, is approximately 7½ per cent., and the value obtained from the chart is 0.08d. on 30½ million units; this represents a saving of £10,166.

We have, then, two distinct annual savings on running charges due to the battery: (1) Standby boiler fuel costs; and (2) difference between steam generation at 8 per cent. load factor and fuel bare cost—and as a check on these we have the saving indicated on the load-factor curve due to the improved load factor, which to be accurate should be reckoned for each month separately. This is the actual improvement due to the battery, and should cover both the other estimates and include the saving due to the buffering effect as well, because the later observations shown in Fig. 7 were made after the installation of the battery. In fact, estimated savings from the load-factor curve should cover all savings on running costs when taken on the whole output. It should be noted here that there is a theoretical curve drawn in on the load-factor chart, based on a test figure obtained for the city stations of 2.5 lb. per kilowatt for 100 per cent. load factor, and the known standby fuel charges as previously detailed. It is necessary also to mention that when Stuart street works act as standby to the city stations allowance is made and included in the fuel costs, from which the actual curve of cost is drawn. The whole of any improvement shown is therefore due to the battery alone. These remarks do not apply to the actual coal load-factor curve, which benefits to some extent from the use of the sub-station, and accounts for its nearness to the theoretical curve. The lowest observations, however, on both the coal and cost curves were, of course, made some years before the installation of the battery, and the lowest one of all was made when the plant was running non-condensing at Dickinson street (on account of alterations to the circulating water culvert). For condensing, of course, these two points would be lowered approximately 33 1/3 per cent.

Actual Results with Dickinson Street Battery

In the table the actual saving on works costs for one complete year's working is given, showing the saving actually made. Nothing has been said about battery maintenance so far; but it should be noted here that the makers have signed a contract to maintain the battery at its rated capacity for a term of fifteen years for the sum of £1,250 per annum, which is 8.3 per cent. per annum on the purchase price. This maintenance is included in the works costs.

	1909 No Battery	1910 With Battery
Output to feeders in kw.h.	25,818,992	29,042,985
Coal used	40,681 tons	39,418 tons
Average price of coal	10s. 11d.	11s.
Increase in coal cost, 1910—1911 ..	....	£164
Total cost per unit output to feeders..	0.368d.	0.368d.
Saving in 1910-11 against 1909	....	£7,620
Total value of saving effected by battery with coal at 10s. 11d.	....	£7,784
Commercial efficiency	....	70.6%

Note.—Calorific value varies between 13,500 and 14,000 B.t.u's per lb.

Summary

Capital Cost.

Saving in favor of battery: First cost, £29,433; annual charges, £1,056.

Annual Running Cost.

Saving in favor of battery:—

	£
As per first year's working under favorable conditions	7,620
Total annual saving in favor of battery	8,676
The estimated saving from calculated standby value was per annum	1,554
From difference in cost of generation between fuel cost and cost at 8 per cent. load factor	8,534
	£10,088

The estimated saving from load-factor improvement was ... ... £10,166 and it must be admitted that the two different ways of estimating the saving check very well with the actual results.

Load-Factor Curve

A load-factor curve showing fuel values can be constructed for any works providing the standby fuel charges are ascertained for a representative boiler, and the fuel consumption per kilowatt-hour at 100 per cent. load factor is known for a representative unit.

The formula used by the author is as follows:—

$$x = \frac{c}{y} + k,$$

where—

x = lb. of coal per unit.
c = standby fuel per kilowatt capacity,
k = running fuel per kilowatt capacity,
y = load factor.

Example for city stations:—

$c = 0.18$ lbs., $k = 2.32$ lb., $c + k = 2.5$,
$y = 50$ per cent. $= 0.5$.

$$x = \frac{0.18}{0.5} + 2.32 = 0.36 + 2.32,$$

$$= 2.68 \text{ lb. per kilowatt-hour.}$$

Records and Care in Use

In the first place, a recording ammeter and a recording voltmeter are essential in order to see that overcharging or overloading does not take place; the former is shown by the voltage line at the end of charge, and the latter can be ascertained by comparing the discharge rates shown on the ammeter chart with the corresponding final volts shown on the voltmeter record. Overcharging is, of course, a matter of definition, and depends on the state of the cells. Charging is continued under normal conditions at Dickinson street 10 minutes after gassing point is reached, before both daily discharges, and for 2 hours once each week, generally on Saturday, and preceding the day (Sunday) when a complete discharge at the 10-hour rating is usually taken out of the battery.

It is the custom to construct daily load curves at Dickinson street like those shown in Figs. 4, 5 and 7, except that colors are used to indicate the various areas. These charts have a very important moral effect, and are daily placed in a frame on the battery switchboard for inspection and for future guidance.

The efficiency of the battery for the day is worked out thus:—

$$\frac{\text{Units output}}{\text{Units input, including booster units}}$$

which we term the "commercial efficiency."

The improvement in load factor on the steam plant is noted, also the ampere-hours of the peak-load discharge. These figures are put on the load curve, and it is easy to see at a glance if the battery is not being used to the best advantage. These load curves are considered the most important records taken, because the value of a battery depends more on the way it is used than on anything else.

A special battery-book is kept, giving details of cell defects and their treatment (for which a 1,000-ampere portable "milking" booster is used), daily gassing, weekly overcharge, and all specific gravities and voltages of individual cells once each week after the weekly overcharge. Three pilot cells are used to serve as a guide to the state of charge, and the specific gravities of these cells are taken every half-hour for the station log sheet, which is the general record of the working of the station usually found in use at most central stations.

The capacity of the battery varies at various rates of discharge, and without these pilot-cell readings it would be exceedingly difficult at times to gauge the exact state of the battery.

General Conclusions

Advantages and Disadvantages.—When considering the value of storage batteries in connection with central station supply, it has been the general custom in the past to compare the cost per kilowatt of capacity with that of steam plant and generator, to the advantage of the latter. It was argued that steam plant and generator cost less, and could be run continuously if required, whereas a battery (if the 1-hour rating was used for comparison) was not to be relied on for longer periods than one hour. It was, and is still, held that the life of a battery would be less than half that of generating plant, that maintenance is exceedingly heavy, operation difficult, and still—speaking generally—a prolific source of worry and trouble.

Batteries were installed, when central stations were first built, large enough to maintain the supply during the night, and at the week-ends, without the assistance of running plant. They were found a great convenience; but generators would be added as the demand on the station grew, and the battery would fall out of use, except for balancing purposes, until, through neglect and ill-usage, it would become of no value to the scheme. In no case would the battery be used except as a luxury, and it was generally expected to require no attention until it got into a very bad state.

Electric traction did something to raise the reputation of storage batteries, owing to the marked saving in plant required for a rapidly fluctuating load, and the resultant economies of this buffering effect.

A properly proportioned battery is supposed to give 1 per cent. to 2 per cent. better ampere-hour efficiency when used on traction as described, and as against the efficiency of a battery used to deal with lighting peaks, due to the greater buffering effect on traction loads.

It is now being recognized that, provided the battery is installed to reduce generating plant, it is a sound commercial proposition when considered in connection with a large lighting load.

Popular Error about Efficiency.—Too much has been made in the past of the supposed inefficiency of batteries; as a matter of fact 70 per cent. to 75 per cent. commercial efficiency can be maintained with care; and if this were not so, efficiency is the least important attribute of peak-load plant, and especially so in the case of a battery. Peak-load units are costly to generate, and allowance is made for this in fixing charges for lighting. Power or daylight units are much lower in price because the cost of generation is much less—so in effect the battery is charged at power costs, and discharged at lighting rates. If some of our large consumers on public supply mains only realized this, they would install batteries of their own, buy current at power rates, and cheapen their own lighting supplies by arranging with the supply authorities for a "restricted-hour" supply, i.e., they would take no current from the mains at peak-load time.

Batteries hitherto have usually only been installed by consumers for the sake of making supplies reliable and independent of accidents outside their own premises.

Importance of Size and Application.—It does not matter how short a period of time during the day, or the year for that matter, a supply is demanded, there must be plant installed to meet it, and it has been found that for all duty of less than 8 per cent. daily load factor, i.e., of less than two hours' demand during the 24 hours of the day, the matter is in no doubt. It most certainly pays to make storage battery provision for this. Beyond this point we must look to advantages other than direct saving in capital cost and running charges to justify the extension of the principle.

It is often said, "What about the overload capacity of the steam plant; is not this sufficient to deal with the peak the battery is intended for?" On occasion, yes; but if reliability of supply is to be assured, the occasion must be that brought about by the failure of the battery, a possible but unlikely occasion if proper care is taken.

Booster regulating plant can go wrong, and batteries are protected normally by circuit-breakers which may open through defect. It is generally possible, however, in the event of serious trouble to parallel the battery without the boosters in circuit; and under such circumstances the battery would prevent total failure of supply under the worst conditions. From other causes of failure a battery is practically free.

It is very important that the battery should be of large enough capacity, not only for normal discharges, but for any short, heavy loads it may be called upon to give out. On the other hand, if the battery is larger than would be necessary to deal with load of the proportions indicated, the direct saving it is possible to show is correspondingly decreased.

Electric Rates and Classification of Customers

Extracts from a Report Prepared by a Member of the Rate Research Committee of the N. E. L. A.

When a business is subject to unlimited competition, all its rates automatically seek a level where they give the owner barely a minimum return, or possibly provide no profit at all, since, when they rise above this level, more competition develops, and when they fall below the competition ceases until they rise again.

In the case of a monopoly, and particularly of various public service monopolies, the rates are not entirely controlled by competition, and in the case of public service monopolies, it is expected that either public sentiment, the courts, or commissions, shall regulate the rates to a point at least as low as they would have been in the long run, if subject to competition.

The degree of monopoly of public service corporations is greatly overestimated, since most of their monopoly is in form only. An electric company may have exclusive rights to supply electricity for light, power, heat, etc., but it has no monopoly in the supply of light, power or heat as such. In the case of electric light it has as active competitors, candles, oil and gas; in the case of electric power, it competes with animal power, gas and oil engines and steam engines; in the case of electric heat, with gas, oil, coal and blankets, and in spite of what may seem to be a monopoly in the supply of these services in the electric form, it finds tremendously active competition in substance—competition which seriously affects its business the moment it raises its prices above a certain point. Below a certain point in its prices, the electric company may have a monopoly, and public sentiment requires that its prices shall, in the long run, be lower than if the competition were unlimited, and this point is where all the prices together produce just a fair return on the investment.

It is for the interest of the owners, as well as of the public, to keep the prices at this point, but for any given short period the owner is always attracted by the idea of a high return and high dividend, so that the apparent or momentary interests of the owner and public may seem to be opposed. However, while the interests of the owner and of the public are at any moment apparently opposed on the question of the total profits, there is another question on which the interests of the owner are not opposed to those of the public, and that is the division of the total profits as coming from the different customers. To secure a given return on a certain investment, it makes no difference to the owners whether this comes mostly from power, or mostly from light; mostly from large customers, or mostly from small, and when the total profits are unaffected there is nothing to lead the owner to take any action, in the way of changing this division adversely to the public interests.

The question of division of costs among different customers or classes, is an entirely separate question from the question of total costs or fair return. Having decided finally, or for the time being, what is a fair return on the investment in a given electric or other public service company, the separate question is still open—how shall the rates that are to produce this income be adjusted as between the different classes of customers?

The first answer (and a theoretically correct one) is that each individual customer should be charged at least what it costs to serve him. The trouble is that this only distributes a small portion of the costs as between customers. If an electric light is burned, or motor used, the electric company uses perhaps a little more coal, costing perhaps ½ cent per kilowatt hour for each kilowatt hour used, but the rest of the expenses are not immediately affected. They are joint costs which may belong to any of the lights or any of the motors, or to some other part of the business.

In many businesses—and especially such a business as electric light and power service—most of the expenses are the same whether any particular customer uses the service or not, and it is only certain small expenses that are necessarily part of the cost of each customer. These latter are sometimes grouped under the general term the "increment cost," the cost incurred by adding that customer to the system, or saved if he is disconnected. The remaining and greater portion are joint costs, which may belong to all of the customers or the customers as a whole. Increment costs must be, or rather should be, apportioned to individuals, or special classes that cause them. Joint costs must be divided in some way as between all the customers.

No absolute accountant's line can be drawn between increment and joint costs. For instance, in railroad freight, suppose a given traffic goes south. So long as cars come back empty the increment cost of extra freight north is only handling and a little coal. All the rest is joint expense to be divided in some way among all the traffic. The moment the traffic north becomes big enough to require extra trains, then the increment cost in that particular case is high, and at that moment increment cost for freight in empty trains now going south becomes small.

It follows that the increment cost which is necessarily incurred by a customer is usually very small, unless we can be sure that he is always the "straw that breaks the camel's back." The fact that he happens to cost a great deal should not be charged against him unless it is always going to require that extra expense to serve him; unless he, or his class, is always going to involve an expense, it is a joint cost and not an increment cost.

It is important to remember that for electric companies and for most public services, these joint costs are by far the most important portion of the total expense. It is seldom that it makes much difference to a railroad whether a single passenger does or does not get on the train. The expenses are the same whether he happens to be aboard or not. It is seldom that it makes any difference to an electric company whether a particular lamp or motor runs or not. It might be possible to compute the effect on the coal pile, but the effect on 90 per cent. of the expenses would be practically nil.

Common Interests of Owner and Consumer

These joint costs must be divided in some way. Now, while the interests of the owner may appear to be temporarily opposed to those of the public on the question of the total of the costs, or the total of the joint costs, the owner, as such, has no interest that would lead him to divide a given total between the customers in any way contrary to the public interest. The question is, how shall the joint costs be divided between the customers that jointly use the service? One method is for the owner or manager to make arbitrary prices to each customer, but it is clearly of no advantage to the owner to charge different amounts under like conditions, and such discriminations are forbidden by law on the ground that they are either due to some improper influence on the manager against the interest of the owner and public, or else an error of judgment.

The simplest method is to select some unit, as ton-miles or kilowatt hours or number of telephone instruments served, and divide all costs in proportion to this unit. Here there is no difference of interest as between owner and public, in choosing the unit, but there will naturally be a difference as between portions of the public. A charge for hotel service by the European plan, helps one class of travellers as compared with a class that prefers the American plan, and so on. Whether an electric company charges per lamp connected, or per kilowatt hour, makes a great difference as between stores and residences, even if the rates are such that the owners of the electric company get the same return on their whole investment. Further, it is perfectly possible to select more than one unit, or, if using a single unit, to make the rate for such unit different for different classes, as one rate for residences and another for business, or one rate for letters and another for merchandise.

Rates by Formula

At the moment there is a call for electric companies to adopt prices as developed from a certain formula, sometimes known as the demand theory. Costs = number of customers × a + kilowatt hours × b + kilowatts of demand × c, and it is well to understand why this, as well as any other formula, would be to the public's disadvantage unless by the merest chance it worked out right for all cases. No matter which formula we use for analyzing costs, it is still true that most of the costs are joint costs not necessarily incurred by any particular customer or customers. Now, if these joint costs are divided in one way according to some formula, there may be still another division which may give better results for the public. If the formula is a sacred one we cannot go behind it, but if not sacred, what test shall we apply to see if it gives the best results? The best result is when the burden on customers is least; i.e., when we get as much business as possible among which to divide the joint costs so that the burden on each customer shall be least.

If we had a growing business, without any existing rates, we should find it difficult to say how we should start, but we cannot imagine a business operating without some rate to start with, and if we have some business and some rate to start with, all we have to do is to see if some change of rates will not give better results and to keep on trying until we can make no further improvement.

Take existing rates. They produce an income which is either less than a fair return, a fair return, or more than a fair return. Now, if the return is less than fair, a new rate applicable only to new business that could not otherwise be obtained, should return something towards joint costs, and will be of no harm to existing business and will be an improvement. If the return is just a fair one, a new rate that produces new business over which to distribute joint costs will not hurt existing business, but will make possible a reduction of rates. If existing rates show more than a fair return, a reduction should be made, but again, if a reduction so as to produce new business is made, further reduction becomes possible.

In any of the cases, it is obvious that the new rate should take as much of the joint costs as it will stand, and this is clearly no injury to the new business, because it need not take the supply unless it wants to, and will not unless it gets some advantage. On the other hand, if new business is asked to share the same proportion of joint costs that is being paid by the old business, it may not be secured at all, and then will not pay anything towards joint costs, instead of paying something.

In a recent article on isolated plants, in the Engineering Magazine, it is stated that the central station operating costs are 1 cent per kilowatt hour (the real cost is usually less). The general expenses are taken at 2½ cents per kilowatt hour. This figure for general expenses probably includes all accounting and distribution expenses, such as maintenance of lines, etc. The article does not give any figure for the fixed charges on the central station, but says that they are three times what they would be for an isolated plant, and later gives the fixed charges of such a plant as 2 cents per kilowatt hour, which would make the fixed charges for central station 6 cents per kilowatt hour, and would make the total central station costs 9½ cents per kilowatt hour. Then the costs of an isolated plant are given as—operating cost 1 to 1½ cent per kilowatt hour; fixed charges 2 cents per kilowatt hour, and general expenses nothing, making a total of 3 to 3½ cents per kilowatt hour. It is, of course, absurd that an isolated plant has no general expense, and that supervision and management expenses do not exist, and that such services where tendered should not be included in the cost.

The article then wants us to infer from the above that the central station cannot by any possibility sell electricity at 3 cents and make its expenses. The costs for the central station, however, are the average costs, made up of all sorts of expenses, and because they may average 9½ cents it does not mean that each new customer will also cost 9½ cents. Each new customer may add something to the total costs, but this addition will have no relation to the average cost of serving the old customers.

Rates Must Vary

For instance, I recently learned of a case where a central station is supplying to all its customers about 6,000,000 kilowatt hours, with an operating cost at the station of about $60,000, an average cost of 1 cent per kilowatt hour. Its general and distribution expenses of all sorts were about $180,000, making about 3 cents per kilowatt hour; its fixed charges were about $180,000, making about 3 cents per kilowatt hour; the total average cost or price for all its output was therefore about 7 cents per kilowatt hour. This price was collected from its customers at different rates varying from 3 cents to 11 cents per kilowatt hour.

This station then had placed before it a proposition for supplying a single new customer with 4,000,000 kilowatt hours annually. In order to supply this customer all it had to spend in the way of investment was about $30,000 for lines, ducts, etc., and for the increased capacity at the station. This, however, was not quite fair, because the supplying of this customer used up some capacity which was idle, and made it necessary to spend another $30,000 very shortly, which otherwise would not have been spent. The real increase in investment made necessary by this customer was then about $60,000, and to make sure that this was reasonable they got out the figures as to what the increased investment would be if they should take on several more customers like this one, and found it less than $60,000 each.

This is a very important point. If a rate can be established for a single customer, and a different rate for the next one, then the increment cost can be figured for each. If, however, a rate is established for a class, we must figure what is going to be the whole result for years ahead, when not one but many customers of the class are added.

To return to our example. 15 per cent., on $60,000 meant $9,000 a year increase in fixed charges. The operating expenses had been $60,000 for 6,000,000 kilowatt hours, and they estimated that for 10,000,000 kilowatt hours the operating expenses would only be $85,000—an increase of $25,000. The general expenses had been $180,000, but this single large customer, or other customers like him, would hardly add anything to the general expenses, though they put down an increase of $1,000. The net result of adding this large customer, and of still other customers proportionately, was, therefore, an increase in the expenses of $9,000 fixed charges; $25,000 operating, and $1,000 general, or a total of $35,000, which, applied to the 4,000,000 kilowatt hours of use gave approximately .9 cents per kilowatt hour.

It was stated that this customer could make his own electricity for about $64,000 a year, or 1.6 cents per kilowatt hour, and the central station to secure his service made a price that came to $60,000 a year, or 1½ cents per kilowatt hour, and the difference between the $60,000 that the customer paid and the $35,000 that it cost to serve him left a contribution of $25,000 toward the net revenue.

This did no harm to the customers who previously had been paying 3 to 11 cents per kilowatt hour, and as a matter of fact, later enabled the company to make a reduction to these customers, which it would otherwise not have been able to make.

In a case like this we naturally feel that a new customer should contribute as much as possible to joint costs; i.e., should be made to pay, in unpopular phraseology, all his traffic will bear, even if we do not charge him as much as we charge the others. Now, in order to determine what he can actually afford to contribute towards joint costs, it is necessary to figure what it will cost him to make it himself, and in most cases of customers like this the things which determine his costs are his demand, his consumption, and his size; in other words, using as a basis to figure his costs, the demand formula above referred to. Hence, in publishing a rate to attract these customers, it is natural to make it on a demand basis, so that each shall pay as much as possible of the joint charges and reduce their burden on others.

But note: While the demand system furnishes a measure of the total station costs it is not for that reason that we use it in making prices. We use it in making prices because it furnishes a measure of the value of the service to the customer and if in any particular case the demand system did not furnish this measure we might use some other measure in order to apportion to him as much as possible of the joint costs, so that the supply to him should be of the greatest benefit to the other customers.

The "Demand" Theory

Now, this explains in part, at least, the popularity of the so-called demand theory. Everybody uses the analysis of costs into demand and output charges, and finds it extremely useful, first, when applied to the central station costs to determine the effect of changes upon those costs, and, second, when applied to the customers to determine the price which will make the supply to them result in the greatest benefit to the customers as a whole. Even when there is no question of the customer making his own electricity, the demand theory still is apt to furnish a measure of how much the new business can contribute to joint costs.

For instance, a customer with a few lamps used long hours will take the trouble to equip himself with gas and maintain Welsbach burners, unless he gets a fairly low rate per kilowatt hour; while another customer, using the same amount of electricity, but on a large number of lamps, can afford to pay a higher price per kilowatt hour, rather than trouble with the gas outfit. It is, of course, better for both customers to be supplied than for one to use gas, and let the other pay all the joint costs.

The demand theory is very apt to give prices that will be best for all, but this is purely because it happens to fit certain classes of customers. The fact that in some cases the best prices can be figured from a particular cost formula, does not prove that the same figuring will give a correct result when conditions are changed.

To return now to the case of the large customer, there is always difficulty in understanding why it is that a large customer can be supplied at so much less than the average price, but here is another analysis which may make it clear.

The central station could build a new small station for a customer close to his mill, and a duplicate of his plant, and by running it exactly as he would run his plant could meet his costs exactly. In such a case it is clear that the old station costs would be 7 cents and a proper price to old customers 7 cents; cost at new station 1-6/10 cents, and the proper price to the new customer 1-6/10 cents. Then when we combine them and run them as a unified proposition, the situation is still the same, and the cost of each does not become the average, any more than a short man could become taller by enlisting in a company of soldiers whose height averaged more than his.

This point about building a small station close to a customer is a very essential one to remember. The central station can always meet the price of the isolated plant because it can build an exact duplicate of the isolated plant and run it as the customer would run it and meet the price, and then, as a next step, the central station by combining the loads can effect a saving and make a profit. In any case it cannot lose by selling to the customer at what it would really cost the customer to supply himself, because in the worst case it operates exactly as the customer would have operated.

Should be no isolated plants

We contend that there should be no isolated plants from the standpoint of economics. Why, then, are there any isolated plants? The reasons are as follows:

(1) Sometimes the central station does not know its business. The cost of an isolated plant may be said to be 3 cents, but the central station may refuse to supply the service at less than 5 cents.

(2) Sometimes the isolated plant does not know its business. The real costs of the isolated plant may be 3 cents, and the central station may offer a supply at 2.9 cents, but the engineer may report that the plant cost would be only one-half cent, and he secures a commission, or at least a job.

(3) Sometimes the owner of the isolated plant is running it for his health, as a hobby or for amusement. The central station cannot very well make a price that will recognize such conditions.

Occasionally the case may present itself where it is really economical to generate part of the electricity at the customer's premises and part at the central station, as when the customer may have water power available. If this amount at any given time corresponded exactly to the customer's requirements, then for this time there would be no advantage from the central station connection, but practically always some of the electricity could be economically supplied from the central station, or else the water power plant could sell some to the central station.

All Savings Benefit Public

Any savings or contribution to the net revenue of the central station are ultimately for public advantage, because whatever increases the profit of the central station brings earlier reduction of rates to its customers as a whole. Hence, a central station should make rates that will get all the business, and while making the rates just low enough to get the business, that could not otherwise be secured, should make them no lower than necessary and in no case below increment cost.

But suppose we adopt this theory. Is it not the value of service? Is it not after all the theory of charging what the traffic will bear? So far as these big customers are concerned, perhaps it is, or rather it is not charging what the traffic won't bear, not charging them any more than their costs would be with independent plants, but securing all that their traffic will bear for the reduction of the burden of joint costs to all customers. Now, when we apply this theory to small customers, we are met with the question of regulation, and the answer is this. An electric company, or any public service, must make its rates lower even than they would have been under free competition.

The theory of value of service applies even in this case. The value of electric light service to anyone is not what he would pay a particular company for electric light rather than go without electric light at all, but what he would pay that particular company for the service rather than get an equivalent service in some other way. The value of the service is never above what one of the competitors offers it at, and regulation of prices is merely to determine what the value of the service from the company in question would have been if no monopoly had been granted; in other words, what the company would have charged, in the long run, if subject to competition.

Whenever the return on investment is higher than is reasonable and equitable, competition will naturally spring up, and the authority that grants the monopoly requires that there shall be a reduction of rates, applicable to those classes whose price would have been reduced by means of such competition. Subject to this exception, each price should be such as to produce the greatest amount of business and make the burden of joint costs least; and the final result will be obtained by basing all rates either on actual value of service, or on what this value would be under free competition. This results, in practice, in a simple, general rate such as obtains in most of our cities, with special classifications for power use, and for large customers, etc.

It will be to the interest of owners, as well as of the public, to adjust rates along these lines, and if rates are made public and open to all alike under like conditions, and so long as these conditions are made in good faith and without ulterior motive, any such proper discrimination in rates is justified and should inure to the advantage of the public as a whole. In practice the method here advocated of determining rates works simply, even if it means that the final figure is determined more by the business judgment of the manager, than by the reports of the accountants.

The revision of rates

There are some tests to be applied to any particular revision of rates, that will perhaps make this idea more popular. First, is it a change that would have been produced in the long run by free competition among companies covering the whole territory? If so, it should be made voluntarily by the owner, or, if not so made, should be forced on him. This test, as to what the rates would have been under free competition, is of course a very difficult one for an accountant to apply, but it is not necessary that it should be applied exactly, and in fact, if applied exactly, would not be entirely satisfactory. For instance, free competition in electric service would probably result in low rates in the centers of cities, and high rates in the suburbs, instead of uniform rates. In this case the public probably acts wisely in requiring uinform rates over the territory, but whether it does or not hurts the public more than the owners, so long as the profits are left sufficiently high so as to continue to attract new capital into the field, and into similar fields that to-day appear as risky as the enterprise under discussion looked when it started. Second, is it a change that will produce new business that will furnish some additional contribution to joint costs? If so it should be made in the interests of the business as a whole. Third, is there any other change that will produce a greater contribution towards joint costs?

Now, the answers to these last questions also furnish a test as to whether a rate is discriminating, in the sense in which discrimination is unpopular, because they ask, "does the change produce **new** business?"

The change in rates may apparently produce some new business, but the business on the new rate may be business that was formerly on the old rate. In such case it is merely a transfer from the old rate, and there is no increase in business, but instead, a decrease in contribution to joint costs, and in such case the new rate does not stand the test. This will often be the case when the customers on the new rate are competitors of those on the old rate. In railroads this occurs much more frequently than in electric companies. If the rate to Jonesville is lowered that may merely shift business to Jonesville away from Smithtown, without increasing the total. If Smith and Jones are competitors, a low rate to Smith may merely mean that Smith does more business at the expense of Jones, but the total business and the contribution towards joint costs are not increased. If, however, the difference in rates is not between competitors, no business is shifted.

One electric company made a special classification of motors. If this had been General Electric versus Westinghouse, it would have meant merely a transfer from one kind of motor to the other and no new business. Instead, the classification was between elevator motors and ordinary motors, reducing the price to ordinary motors. Here the change brought in more ordinary motors to reduce the burden, but did not affect the business in elevator motors until finally the reduction in joint costs warranted a general reduction which they would not otherwise have obtained. Hence, the discrimination between motors was assumed to be justified in this case.

Even between competitors a differential may still produce new business that is not obtained at the expense of old business. The big store that can put in a plant competes with the small store, but the lower rate to the big store (unless seriously below what it would cost the big store from its own plant) does not hurt the small store. The big store does not, by reason of buying electricity, take any more business from the small store, than it would if the big store had its own plant.

Must discriminate with care

One rate for residences and one rate for stores would never transfer business and would seldom be open to criticism. On the other hand, one rate for two family houses, and another for single houses, might transfer business from one to the other, and in general might be undesirable. One rate for ice making, and another rate for water pumping would almost never transfer business; hence is fully justified. One rate for drug stores and another for saloons, would be apt to transfer business, and would have to be closely scrutinized. One rate for theatres and another for amusement places, would be apt to be discriminating, because it would be apt to transfer business, and a rate for newspaper offices different from ordinary printing offices, would again be subject to suspicion. On the other hand, a rate for hotels might be different from a rate for factories, without much chance of any transfer of business.

The point of making these illustrations is to show how the methods advocated agree with our general ideas. In fact the following is usually a pretty safe guide when considering whether a differential is justified:

If the differential is between customers or classes who compete with each other, the burden of proof should be on those who propose or advocate the differential, and the differential should not be allowed unless it is shown that it is necessary, and no greater than necessary. The differential between large and small customers is of this nature. It is necessary, and in fact it would be better for the small customers, if the differential should be made larger than it is now, so as to get the big users to contribute something towards joints costs instead of nothing, as happens when they do not use the service; but it should always be watched carefully, because any error in adjusting it will merely transfer business from one class to another without really producing any new business.

On the other hand, for a differential between classes which do not compete with each other, the burden of proof should be on those who object to the differential; since, if the classes do not compete, the differential will not transfer any business, and any increase in business will be genuine and for the advantage of all.

The following rules will show how the foregoing methods can and should be applied.

For the company—adjust the rate to the various classes so as to get the greatest volume of business among which to divide joint costs, and in order to do this, first make sure that no class is supplied at a loss; and that each class bears as much as it can contribute (or would have paid under free competition of the joint costs. This means make the rates proportional to the value of the service, less the savings due to monopoly. This should result in a single general rate for the general public, at least as low as would have obtained under free competition. It should result in class rates for power, street lighting, charging of batteries, cooking, etc., lower in many cases than the general rate, and should result in differentials for large customers, all of these class rates and differentials being only as low as necessary in order to get the business. The differentials for large customers should be low enough to get the business now done by isolated plants.

For the public—allow the company to make any change it likes as between customers or classes who do not compete with each other. When a change is proposed that makes a difference between customers or classes that do compete with each other, allow the change only when it is clear that the result will really produce new business, and not merely transfer business as between competitors. When the rates produce more than a fair return, provide for reducing the rates to those classes which would have obtained a reduction if competition had been free.

This is the line along which companies are now developing. The only weak point in their present situation is that they are not making the differentials in favor of large customers (and of certain uses, such as cooking, etc.), enough to get the business, and this requires the small customers to pay more towards joint costs than would be necessary if the rates for big customers were made low enough to shut down every isolated plant, where the owner knew his costs and was not running it for his pride or his amusement.

New Books

Practical Mathematics for the Engineer and Electrician—By Elmer E. Burns and Jos. G. Branch, B.S., M.E.; the Jos. G. Branch Publishing Company, Chicago; price $1.00. It has been the aim of the authors to make this book of value to operating engineers and electricians who have never had the advantage of a college education. The book is elementary, written in simple, clear language and treats only of such subjects as are of special value to all practical workmen; a few simple illustrations.

The Electric Motor and its Practical Operation—By Elmer E. Burns; the Jos. G. Branch Publishing Company, Chicago; price $1.50. The subject of the electric motor has been treated simply and clearly and with so little mathematics that all can understand it. The aim of the book is especially to help the man in the engine rooms and shops to a first hand understanding of motor principles; very clearly illustrated.

Alternating Currents Simplified—By Elmer E. Burns. The Jos. Branch Publishing Company, Chicago; price $1.50. This book gives the electrical worker a clear understanding of an alternating current in such a way as to give him a safe and sure foundation for his work. The aim is not a description of the various types of a.c. machinery, but an explanation of principles, in language so simple and clear that the novice can understand it; very well printed and illustrated.

Mr. Jno. P. Fox has begun an investigation of the tramway problems in Montreal, on which he has been engaged by the city to make a report.

ELECTRIC RAILWAYS

The Present Tendency of Street Railway Operating Expenses*

By Mr. J. J. Burleigh

A paper on "The Present Tendency of Street Railway Operating Expenses" might, with a due regard for accuracy, be so condensed as to set forth the answer to the proposition in the single word "upward." Although such a contribution would possess the doubtful merit of brevity, it would be doing no more than stating a fact that is obvious to most, if not all of us. It would be citing an effect without giving the causes therefore, proclaiming a result but throwing no light upon the conditions which produced it. My purpose will be to set out briefly some of the figures and factors which will explain and make clear why the operating expenses have been mounting higher and higher during the past years, and my observations will be based upon the actual experiences of the company with which I have the honor to be connected.

One of the chief reasons why operating expenses have been increasing has been the tendency toward longer hauls for a single 5-cent. fare, due to additional transfer privileges and the extension of fare zones because of the expansion of municipal limits coupled with franchise obligations to carry passengers from any part to any other part of a given city or town reached by a company's lines without extra charge. The growing demands of the public for more service and better service, necessitating more costly equipment and heavier power outlays, has also been a factor. Wages of trainmen and other employees have been increased from time to time, which has added materially to the burdens of operating from a financial point of view and the single item of taxes, including franchise, real and personal, as represented in cash outlay has been nearly doubled on a car-mile or car-hour basis within ten years, making this charge alone an exceedingly heavy toll exacted from the company's gross revenue.

In an endeavor to get at the underlying facts let us subdivide the costs of operating and consider the factors which have been responsible for the increases. We will begin with the maintenance of way and structures. Our experience has been that this item accounted for 1.154 cents per car mile in the year 1904, went to 1.189 cents in 1908, to 1.453 cents in 1909, to 1.888 cents in 1910, to 2.926 cents in 1911 and to 2.999 cents in 1912.

The increases are largely due to a higher wage scale for track and line laborers and an advance in the price of materials used for replacements and repairs. Ten years ago laborers could be hired for 15 cents an hour against a rate of 17½ or 19 cents an hour to-day. This shows an increase of 16 2-3 per cent., and men who are charged with the supervision of this labor declare unequivocally that there has been a diminution of efficiency equal to 25 if not 30 per cent. In other words, the class of men available for this character of work to-day makes it necessary to hire at least four men for every three employed at similar tasks ten years ago. Nor is the end yet, for there is already ground for the belief that a still higher rate of wages will have to be paid with the coming of spring.

Rails, frogs, switches and mates and all other special work chargeable to operation as replacements have gone up in price, as have fishplates, tie rods, bolts and practically everything else which enters into repairs, from 15 to 25 per cent. over the prices of ten years ago, and modern carhouses and concrete roadbeds bring with them certain necessary outlays which must be charged to operating.

Demands in the way of street pavements have grown more exacting and incidentally more costly. Where the relatively inexpensive macadam pavement sufficed formerly it has been superseded, by virtue of franchise obligations, by wood-block or specification granite block which cannot be laid short of approximately four times the cost of macadam. Reduced to a car-mile basis, our experience has shown that street-paving requirements cost 0.172 cent in 1904 and 0.309 cent in 1912, covering a system which includes populous cities, suburban towns and rural communities.

At the same time the cost of bridges has increased, due also to the necessity of providing for the heavier rolling stock, while the rather insignificant item of ties has contributed its share to the general burden of expense. In the past ties were used that cost about 60 cents each, but modern practice dictates the use of cresoted ties at a cost of about $1 each. As they are placed closer together under the heavier girder rails, more of them are required per mile of track. While figures show that the initial cost is many times greater, on a car-mile basis, than formerly, the changed conditions return a measure of compensation in the form of materially longer life of specially treated ties.

Under the head of transportation reference may be again made to the larger and heavier type of cars now used. More energy is consumed in propelling the heavier vehicle, and the car of to-day must be equipped with air brakes as well as hand brakes, unit switch control so that cars may be operated in units or multiples and devices for preventing or minimizing accidents, such as fenders, platform doors or gates and folding steps, all of which have a tendency to increase the cost of maintenance.

Increase in Wages

It is in the item of wages for motormen and conductors and the cost of supervision that larger inroads into a company's revenues may be discerned. In the case of the company with which I am most familiar the cost of wages for trainmen has increased nearly 25 per cent. on a car-hour basis, from 40 cents per hour in 1904 to 49 cents in 1912, and during the same period the cost of supervision has increased as much, if not more, the actual percentages not being readily obtainable because of a rather radical change in the classfication of the account. Under the head of transportation, mention may also be made of the sprinkling of tracks. Where formerly it was deemed sufficient to sprinkle with water many municipalities now insist upon the dust being laid with oil, an operation which has added to operating charges to a measurable degree.

In the item of taxes the street railway company bears its full share of the cost of every public improvement and the governmental outlays of every community in which its property is located besides meeting municipal or state demands in the form of special exactions, or assessments on gross receipts, or in the form of franchise taxes. Higher standards of living and the desire on the part of taxpayers for greater municipal conveniences, better sanitary conditions, more police and fire protection and improved educational facilities all make for increased tax rates and larger tax bills, which must be met from the accumulation of nickels representing rides, so far as the street railway company is concerned. When to all these is added an increasing franchise tax on gross receipts, as has been the situation with which we have been confronted, it is easily understandable that the burden of taxation has been growing no lighter as the years have gone by.

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*Presented at Conference of American Railway Association.

To state the facts concretely let me say that in 1904 the taxes paid by the company the writer represents amounted to 5.12 per cent. of the total operating revenue; the cost per car mile was 1.301 cents and the cost per car hour was 11 cents. Growing in volume each year, the corresponding figures for 1912 were 7.12 per cent., 2.226 cents and 19 cents respectively. Here figures are more eloquent and more illuminating than words.

One other source of expense properly chargeable to operating is worthy of consideration. It is one that had its inception in the comparatively recent past and yet has assumed sizable proportions. It concerns the employees and working conditions and may be designated by the word welfare. Distinct from the requirements of a legislative enactment known as an employers' liability and workmen's compensation law, in force in our State, the welfare work of the company with which the writer is connected comprehends sick benefits, life insurance and pensions paid voluntarily by the company without contributions on the part of the employees. Started in 1911, the cost of these beneficial features amounted in the aggregate to $30,320, or the equivalent of 0.063 cent per car mile, while for the year just ended the outlay had grown to $37,757, or 0.08 cent per car mile. This was in addition to other minor outlays for the promotion of social functions, dinners, entertainments, smokers, outings and inter-division baseball league of twenty teams, pool tournaments and other games and contests for the benefit of the trainmen and members of their families. The workmen's compensation act above alluded to called for an expenditure, in addition to all of the foregoing, of something like $27,000 during the first twelve months it was in force.

With these observations, treating as they do of only some of the elements of operating costs and substantiated, I dare say, by the practical experience of every man actively engaged in the industry, it is not difficult to see "The Present Tendency of Street Railway Operating Expenses."

Our problem is to bring the facts home to the public, to the municipal authorities and to the state legislatures so that they, too, will see and be convinced that there is a limit beyond which the street railway cannot go and still fulfil, in an efficient manner, the purpose for which it was created; that the burdens cannot be made too heavy without curtailing its sphere of usefulness or retarding its efforts as an upbuilder and developer of the communities it serves.

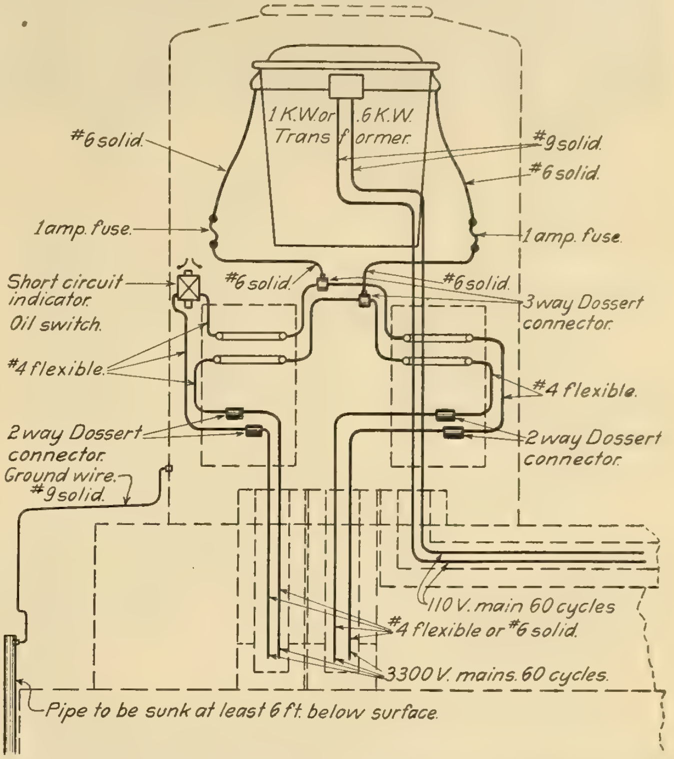
Cape Breton Electric Company

During the coming summer the Cape Breton Electric Company, which operates the Sydney & Glace Bay electric railway, will construct a sub-station for distributing railway current at a point on the Glace Bay division known as Reserve Junction. This sub-station will contain two 250-kw. step-down transformers furnishing 2200 volt, 2-phase, 60-cycle current to a 300 kw. motor-generator.

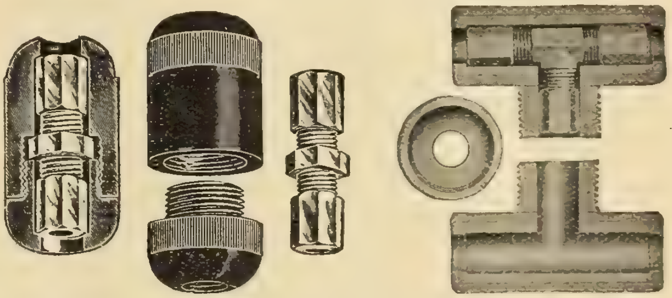
A 10-mile transmission line will be built from the power station at Sydney to the above sub-station. This will be 22,000 volt, 3-phase. For supplying this line, an additional bank consisting of two 250 kw., 2200 volt, 2-phase to 22,000 volts, 3-phase transformers will be installed. This latter bank of transformers will operate in parallel with a bank at present supplying 22,000 volt current for the company's transmission line to North Sydney. Included in the above work will also be the necessary switching equipment in both the Sydney power station and the reserve sub-station. The extension work will be under the supervision of Mr. E. L. Milliken, manager.

Dossert Connectors in Signal Work

The accompanying illustrations represent a typical installation by the signal department of a trunk line railway and show the application of Dossert connectors to the wiring of a 3300 volt transformer and sectionalizing case. The three-way connectors are used in connecting up the primary leads across a 3300 volt main and the two-way connectors are used in the mains themselves at the point indicated in the wiring diagram.



Plan of Wiring of 3,300-Volt Transformer and Sectionalizing Case. Showing Application of Dossert Connectors



Types of Two and Three Way Connectors, Showing Detail and Insulating Covers

The Dossert two-way and three-way connectors and the method of application of each type are shown in the bottom illustrations. The two-way connector may be applied to stranded cable or to solid and single strand wires. The three-way connector is similar in form and application to the other. Insulating covers are available for both types.

Quebec Rapid Transit

The Bill of the Quebec Rapid Transit Railway Company has been before the Railway Committee at Ottawa. The new company has a capital stock of one million dollars, and head office is in the city of Quebec. It is proposed to construct an electric tramway from Quebec to the Isle of Orleans, and to construct a bridge from the north shore of the St. Lawrence to the island. A couple of branch lines are provided The committee adjourned the consideration of the bill with a view to changes being made.

Illumination

The Production of Artificial Daylight

By Allan B. Wearing, A.M.I.E.E.

In the following article it is not intended to deal with the lighting of rooms in private houses, but with the illumination of large premises, such as stores and factories, more particularly where a color true light is indispensable, though the general principle of what is stated applies to all forms of artificial lighting. The claim is made by the writer that an indirect or semi-indirect system using arc lamps as the source of illumination is best suited for these conditions.

Illuminating engineers are all aiming for the ideal artificial light which may be described briefly as resembling **bright diffused daylight** such as may be obtained in a suitably proportioned and well-lighted room facing a northern sky. Unfortunately many manufacturers did not originally study the comfort of the eyes, and they failed to recognize the fact that eye-strain must follow the use of systems which are not conducted on strictly healthful lines, while too much attention has been paid to the efficiency of the light source and its selling properties for profit making. The general public, however, owing to the efforts of illuminating engineers and opticians, are at last finding out that eye-protection they must have, and they will no longer submit their eyesight to harmful direct rays that damage the sensitive retina of the eyes and also seriously affect the nervous system. More recently, however, the manufacturer is working in direct harmony with the laws of nature and it is one of the objects of the present article to give a few examples of the **"daylight"** system of lighting, as practiced by the Canadian Union Electric Company, Limited, and which as nearly as possible gives the ideal "diffused daylight effect" at night.

This system is not in reality a new one as it has been generally installed all over the world, and is daily gaining in popularity on account of its efficiency and the hygienic conditions surrounding its use; but it may be a new system to many readers in this part of the world, and as such will be interesting owing to the fact that modern arc lamps are used as superseding metal filament lamps and because of the higher efficiency and better quality of the light.

For ideal light which gives perfect comfort to the eyes there are two essentials—**diffused light** and **daylight quality.**

Diffusion may be produced in two ways—refraction-obstruction, and reflection. Refraction-obstruction is the most familiar (and most wasteful) method. A general example is that of an incandescent lamp enclosed in a semi-transparent globe which probably absorbs about 50 per cent. of the original light. Reflection is now generally recognized as the best method of diffusion and is the principle that has been adopted in the indirect and semi-indirect lighting system by arc lamps, which is described below.

The Union **"daylight"** system of indirect arc lighting is carried out in any of three ways, all of them involving the basic principle of shielding the eyes from **direct rays** and of illuminating entirely (or almost entirely) **by reflected light.** The three methods are known respectively as follows: (a) the inverted method, Fig. 1; (b) the indirect method, Fig. 2; (c) the semi-indirect method, Fig. 3. The three diagrams give a rough idea of the distribution of the light-rays in each method and will be easily understood.

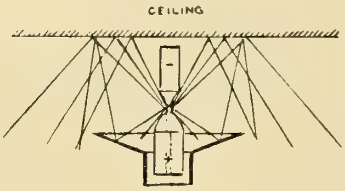


Fig. 1

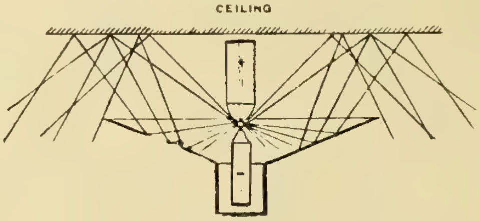


Fig. 2

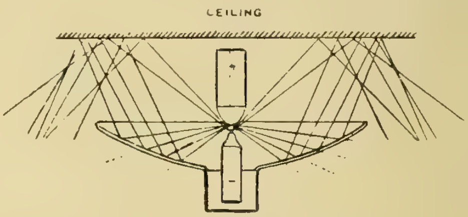


Fig. 3

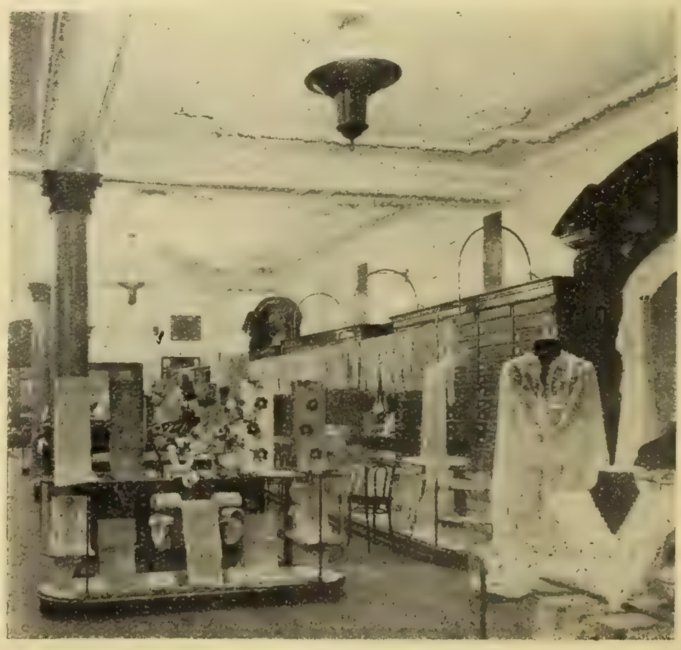


Fig. 4

(a) In the inverted method the carbons of the arc lamp are inverted so as to project the light upwards to a white ceiling from which the light is reflected and evenly diffused downwards over a large area; a small under reflector shields the eyes from direct rays.

(b) In the indirect method the light rays are projected downwards and are thrown back to the ceiling from an opaque under-reflector.

(c) The semi-indirect method is similar to the indirect but some of the light passes through a semi-transparent under-reflector.

Each method has been designed to suit different conditions occurring in practice, but it is not here necessary to go into technical details. A good idea of the results obtained is seen from the accompanying illustration, Fig. 4, which shows a very equal diffusion resembling the definition given above of the ideal light.

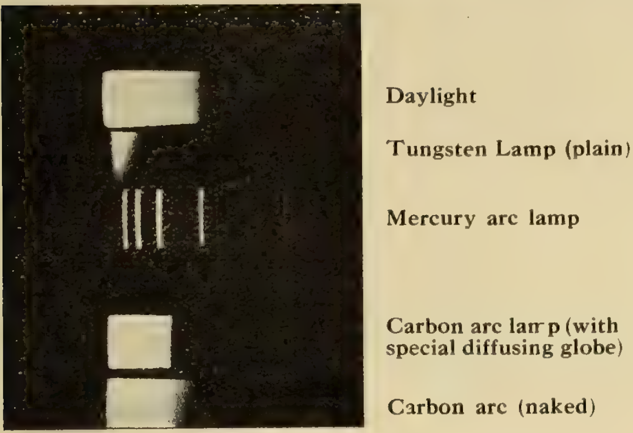


Fig. 5—Spectrum of daylight compared with Tungsten lamp Mercury arc lamp, Carbon arc lamp with globe and Carbon arc without globe

Daylight Quality of Light as Shown by the Spectrum

Daylight is not harmful to the eyes and, therefore, an artificial illuminant that most nearly resembles it is the best from the hygienic point of view. In a recently published series of experiments made by a prominent association in the quest of artificial daylight the following results are reported:—

Artificial daylight was obtained by using a screen of three different colored glasses with a metal filament lamp as the light source. The ideal absorbing screen had a transmission of about 15 per cent. The specific consumption was about 10 to 12 watts per candle. These experiments are extremely valuable in showing the serious loss in efficiency by using this method of substractive production of artificial daylight.

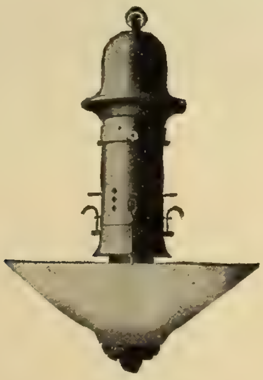


Fig. 6

Let us now consider the spectrum—the recognized test which gives us the true comparison between daylight and artificial light. The illustration herewith, Fig. 5, is an exact reproduction of various spectra, obtained photographically, viz., daylight, compared with tungsten lamp (naked), mercury arc, carbon arc (with diffusing special globe), and carbon arc (naked). The spectra were taken under exactly equal conditions with equal photographic exposures and for equal photometric intensities. The reader will notice that the two carbon arc lamp spectra, in the illustration, very nearly resemble that of daylight, and consequently when the light is reflected and screened from the eyes, as shown in the **"daylight"** system of illumination, the result and effect is the ideal artificial light as defined at the beginning of the article.

The only point now remaining is that of efficiency, and fortunately not much is lost in substractive transmission or reflection. If the coefficient of reflection of the ceiling is poor an over-reflector of high reflective value is subsituted with excellent results, and, while it gathers no dust, is easily cleaned. The efficiency of these lamps, therefore, is remarkably good and in the illumination of several large interiors the cost has proved to be little more than half that of ordinary lighting by metal filament lamps. Fig. 6 shows a standard type of arc.

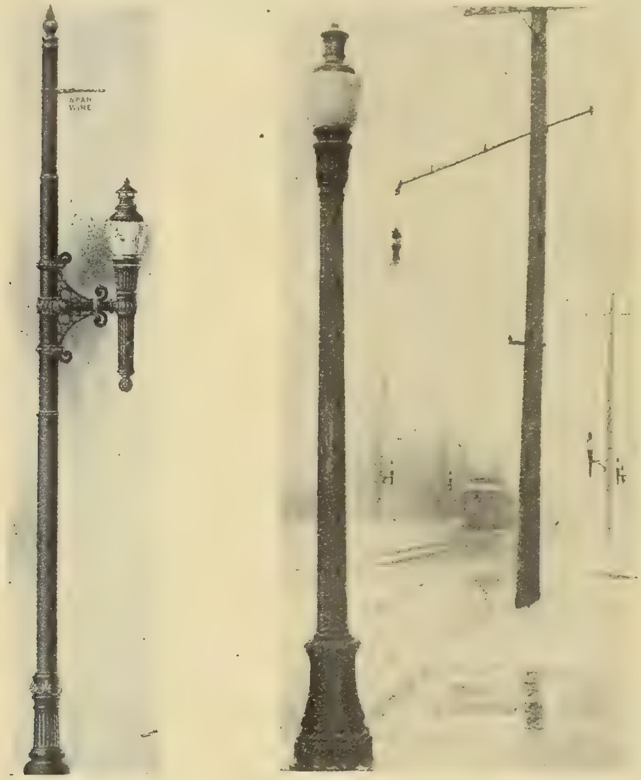
This system of lighting should be most valuable in all department stores, textile mills and factories—in short—all places where daylight illumination is required that is color-true in all respects. For some years past in Europe and Great Britain there has been an arc lamp on the market especially designed for color matching, the custom being to take the goods under the lamp to obtain daylight conditions. The fact that similar lamps are still being placed on the market accentuates the point that the ordinary form of incandescent lighting is not suitable for color matching, and that a substitute is necessary. The system described above obviates the necessity for any such installation in that the whole premises is now illuminated by artificial daylight.

Trial of Ornamental Arcs in Vancouver

Early in January a temporary installation of "G.E." ornamental magnetite luminous arc lamps was made by the city of Vancouver, when the superiority of this class of street lighting over the ornamental incandescent system of lighting, at present in use on the principal thoroughfares of the city, was clearly demonstrated. This installation was made on South Granville street, between Ninth and Tenth avenues, and consisted of six brackets attached to trolley poles, and one ornamental standard placed at the corner of Tenth avenue and Granville street. Each standard, or bracket bears only one arc light.

This ornamental luminous arc lamp is known as the Great White Way type. It consumes approximately 510 watts, and an efficiency of .79 watts per mean spherical candle-power is attained. The lower electrode is in the form of a tube filled with a composition containing magnetite, and has a life of approximately 150 hours. The trimming operations are very simple. Only one electrode is required at each trim. The globe breakage is reduced to a minimum because the globe is large and away from the arc; also its removal for cleaning is unnecessary, and hot particles cannot drop on it. The simplicity and durability of the lamp assure relaibility and economy of maintenance. The large amount of illumination also renders possible their installation with a spacing of twice the distance maintained in connection with any other system of ornamental street lighting. The poles are easily installed as they have a minimum number of pieces to assemble, all goosenecks, mast arms, cross arms, etc., being eliminated. By using direct current through a rectifier system the line loss is greatly reduced; for example, if alternating current is used, the watts loss per 1,000 feet of single conductor cable will be about double the loss with direct current of the same amperage. As may be seen from the accompanying illustrations, the lighting units are of simple yet effective design, and enhance the appearance of a street by day, as well as by night.

The lighting system here described is the latest development in the science of street illumination, and its successful trial at Vancouver marks its first appearance at the coast. The demonstration has been most favorably commented upon by every one who viewed the trial lighting. The city authorities were enabled to make the necessary tests through the co-operation of the B. C. Electric Railway Company, who carried out the necessary line work, and also placed the trolley poles on South Granville street at the disposal of the city electrician during the period of the trial installation.

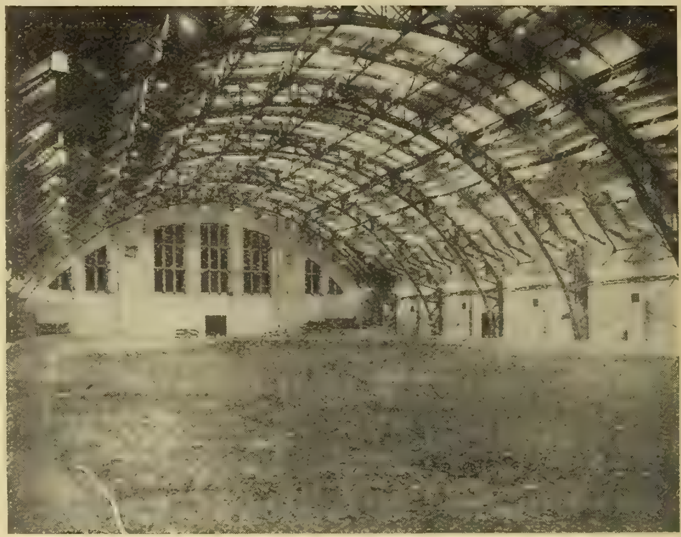


Type of arc lamps being tried out in Vancouver. Note lamps in distance attached to wooden poles

The success of the new lighting system is evidenced by the fact that the Fourth Avenue Ratepayers' Association have instructed the city electrician to install ornamental luminous arc lamps on that thoroughfare, between Granville street and Alma Road, a distance of about two miles. This will necessitate the use of 200 of these arcs, and will effect a noteworthy improvement in the illumination of this district. The city electrician has recommended that the light brackets be placed on the steel trolley poles of the B. C. Electric Railway, thereby reducing the multiplicity of poles which would be required if ornamental standards were adopted. The property owners on Broadway have also expressed themselves in favor of the new lighting system, and it is probable that an installation will be shortly made on this thoroughfare, similar to that which has been proposed for Fourth avenue.

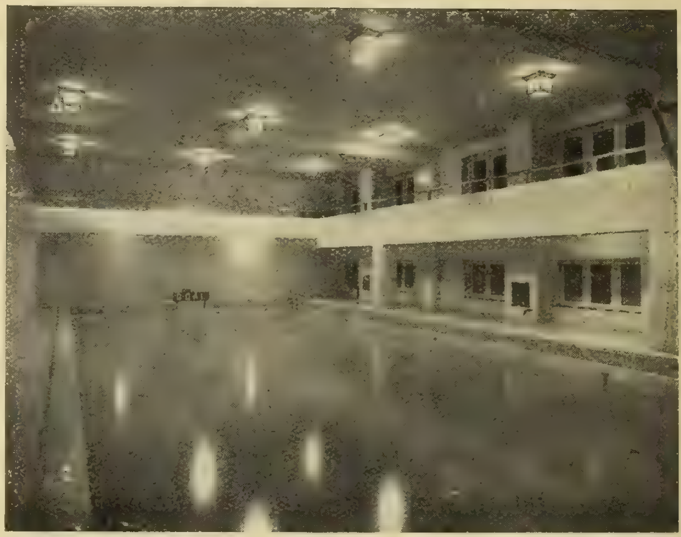
Fine Results With X-Ray Reflectors

The two illustrations shown herewith portray installations of X-Ray bee-hive reflectors recently installed in two buildings of the Northwestern University at Evanston, Ill., one in the gymnasium and the other in the swimming pool. These photographs were made solely by the light from the lamps and reflectors, being taken at night and no flashlight or other extra source of light being used. The resulting even illumination obtained by using these scientifically designed reflectors is very simple. In the gymnasium where baseball practice and similar games are indulged in, it was necessary to obtain a "sky" effect and this was arrived at by inverting X-Ray reflectors above the girders with the results shown. Perhaps the most important point in this installation is that unless one stands directly under one of the reflectors and looks straight upward, not a single light source can be seen. The reflectors themselves are concealed in fixtures designed to be in keeping with the ornamental scheme of the building. The gymnasium room is 129 ft. by 193 ft., and the arched roof is 50 ft. high at the centre.



A properly lighted gymnasium

The swimming pool photograph was also taken at night without the aid of any other light. The opaque bee-hive reflectors here used are contained in the ornamental fixtures shown, and a few additional small lights are also introduced to give life to the fixtures. The distinctness with which the bottom of the tank can be seen is very noticeable as is also the agreeable absence of glare.



Swimming pool—Reflectors in ornamental fixtures

The nineteenth annual meeting of the National Fire Protection Association will be held on March 26th and 27th, 123 William street, New York City, when reports and suggestions for changes in the National Electrical Code will be considered. Advance copies of the committee reports on suggested changes have been sent out. The suggestions are numerous, but do not appear to indicate any very radical changes in the existing code. The National Code is revised every two years and attention is called to the fact that the next revision will not be till 1915.

The Dealer and Contractor

The Retail Dealer and Electric Appliance Sales

To collect information useful to the whole industry on the subject of electric-appliance sales and present conditions in the trade, the Electrical World recently mailed letters of inquiry to a large number of retail dealers and contractors. The list included cities and towns of various sizes in every state and section of the country, thus insuring not only thoroughly national representation in the opinions expressed but the reflection as well of the views held in both large and small communities.

The questions asked are given below, together with a tabulation of the replies received from the dealers. Frank statements in reply were encouraged by assurance that the individual sources of the comment and information received would be treated with all confidence.

As set down in the following paragraphs, the replies received from 424 representative retailers who answered have been carefully classified and analyzed, in the belief that effective light may thus be shed on present conditions in the electrical trade and the readjustment needed to place trade relations on a more stable basis.

In answer to the first question, relating to the device most satisfactory to retail, the replies were, as might be expected, overwhelming in favor of the electric iron. Of the total number, 304 gave the iron first place, the next place being given the electric toaster with 36 votes. Other appliances receiving mention were as follows: Motors, 25; vacuum cleaners, 20; electric fans, 18; lamps, 15; washing machines, 14; electric stoves, 13; percolators, 7; warming pads, 6; radiators, 3; curling irons, 1. Similar estimates of the relative values of other appliances besides irons were afforded by the replies to the fourth question.

The greatest difficulty met by the retailers in building up a profitable flatiron business, according to the results of the canvass, seems to lie in the activity of central stations in selling devices at cost or even below cost in order to further the consumption of electricity. Some of the comment received from dealers on this policy of the central station was particularly bitter and indicates that the ill feeling engendered between local branches of the industry may embarrass other relations essential to the development and prosperity of both parties.

As one correspondent pointedly asserted, the customer quite naturally expects that the central station will prefer to sell him a device that consumes a large amount of electricity and he is not to be blamed if he at once suspects any price cutting which can be attributed to this motive. From the dealer, however, who has no further interest than the sale of appliances and the making of a satisfied customer, the purchaser expects unbiased advice; and later, feeling that he is getting an economical, efficient iron, he will have no fear about making liberal use of it.

In a case cited by the writer already quoted the central station a year ago gave away, absolutely free, 200 irons. When the first month's bills came to these 200 users the increases evident caused much dissatisfaction and criticism of the company's intentions in giving away the irons. Even now the customers who kept the free irons, according to the correspondent, do not use them nearly so much as they might have done had they bought the irons in the first place. "We know," writes one contractor, "that the electrical dealer can sell heating and cooking devices more easily than a central station, and the only reason for this is that the consumer knows (or at least he thinks) that if he purchases from a dealer he is getting a device that will consume the least amount of energy."

Cheap and consequently poorly constructed irons, such as are sold by the department stores and hardware dealers, are also credited with injuring the legitimate business of electrical supply dealers. The low price at which these goods can be profitably sold embarrasses the dealer with a first-class article and, later, the poor service given by the cheap iron destroys confidence in electrical devices in general. Several correspondents also cited the central-station rate for electricity as being too high for the economical operation of irons.

Guarantees too Generous

The generous guarantees proffered by certain manufacturers seem to be another difficulty in the way of the small dealer, whose margin of profit is already pared to the livable limit by sale conditions. The iron itself may be injury-proof, but such incidents as blown fuses, broken cords, etc., which follow in the wake of its installation sometimes prove expensive to the local dealer, on whom the customer depends to make good the sweeping guarantees of the maker. Blowing of fuses caused by the extra current demand of the irons, breaking of cords, attachment plugs, etc., are all accidents which, although clearly outside the makers' guarantee, cannot be so easily explained away to the customer's satisfaction, nor can he be convinced that he should pay the cost of sending a man to make such repairs. Rather than argue his position as to the extent covered by the guarantee, the dealer sustains the cost of the repairs and thus absorbs his own profit.

While a number of dealers flatly insist that they have received "no assistance of any kind" in furthering their iron and apparatus sales, the majority stand ready to admit that the advertising done by the manufacturers has awakened the public's interest in the use of electric devices. The answers received to the sixth query, however, show that, in an overwhelming proportion of cases—277, in fact—the customer enters the store and asks simply for "an electric iron," leaving the selection to the dealers' judgment and experience. Only seventy-one dealers reported that their customers demanded a special make of iron as the result of national and local popular advertising. Thirty-five others traced the demand for a particular brand to the customer's previous experience with the same make or the advice of a friend. In at least six places from which responses were received local pride in a nearby electrical factory controlled the choice of purchase. Many of the dealers reported that their own advertising in local papers was especially effective, although they profited also from the campaigns conducted by the central station. Others insisted that for their greatest assistance in making sales they depended upon the efforts of their own salesmen and their display windows. Satisfied customers and free trials of the apparatus were also cited as useful factors. In the language of the dealers themselves,—"Customers rarely ask for a particular make and can be easily influenced from one to another by the salesmen." "The choice of the iron purchased is usually left to the dealer's judgment." "Most customers want the iron the dealer recommends." "Few laymen know that there is any difference in electrical devices."

Replies Received From Dealers in Electrical Devices

1. Q.—What energy consuming device is the most satisfactory to retail? A.—Electric irons, 304; toasters, 36; motors, 25; vacuum cleaners, 20; fans, 18; washing machines, 14, etc.

2. Q.—What is the greatest difficulty, if any, you are meeting in building up a profitable flatiron business? A.—Cutting of prices by central stations to cost and below cost. Competition from poorly constructed and cheap devices. Unlimited guarantees of manufacturers.

3. Q.—What is the greatest assistance you are receiving in building up flatiron business or sales of other devices? A.—Assistance of manufacturers, general and local advertising. Dealers' sales effort and advertising. Central station activity. Window and store exhibits. Also complaints of "no assistance from any source."

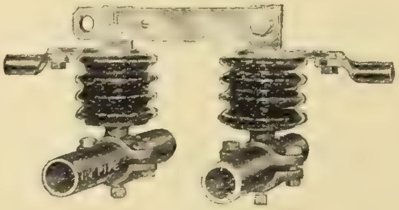
4. Q.—What electric heating or cooking devices, besides flatirons, do you find it most profitable to retail? A.—Toasters; percolators; electric ranges; luminous radiators; grills; stoves.

5. Q.—Are you actively promoting the sale of any one line, or are you carrying in stock various makes of electrical devices? A.—Carrying only single line, 122; various makes, 265.

6. Q.—Do you find that most customers ask merely for "electric irons," or is there a demand for some one make? If there is a decided preference for a particular make, to what do you attribute this demand? A.—Ask for merely "electric irons," 277. Demand special make, owing to popular advertising, 71; owing to previous experience, quality, etc., 35.

A New Idea in Disconnecting Switches

It has been the general practice among manufacturers of disconnecting switches to use the single blade idea in connection with the familiar sweated and pinned clip construction. Users of switches built in this manner acknowledge that the inherent weakness of a switch made thus is the probability of the clips not making good contact with the blade, if the switch should heat sufficiently to melt the solder, thus causing the switch to heat still further, due to reduced contact surface area.



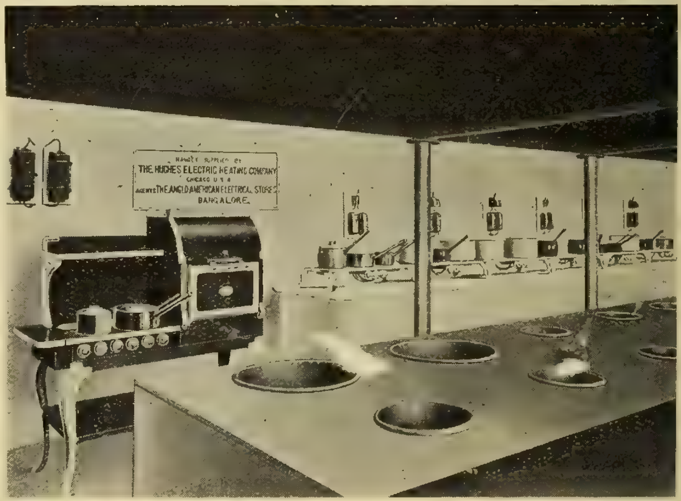
With the idea of surmounting such difficulties, a new line of switches has been designed in which the usual pair of clips is supplanted by a solid copper tongue, cast integral with the switch top. This tongue is milled so as to receive the two blades, which are made of the proper carrying capacity, and separated such a distance as to allow of their being firmly closed over the tongue, one on either side. The blades are equipped with take-ups, so as to compensate for wear on both the tongue and blades. This is shown in the illustration herewith, this switch being a 6,600 volt, 300 ampere type, for 1¼ in. pipe mounting.

Another interesting feature of construction is the absence of the usual unsightly clamps used to fasten the switch tops and bottoms to the porcelain. It will be noted from the cut that these parts are so designed as to materially add to the appearance of the switch, the method of rigidly anchoring them to the porcelain being an original, patented idea. All contact surfaces, current conducting parts, and other essential dimensions are very liberally designed, the paramount idea being to give such a margin of safety that as the station capacity increases, no fear need be felt as to their successful operation.

This style of switch construction has been standardized and a complete line is available, varying in capacity from 300 amperes to 2,000 amperes, and from 2,500 volts to 33,000 volts, for either pipe or flat steel base mounting, using corrugated porcelains or line insulators as may be desired. A decided advantage in such a construction lies in its being more rugged and simpler, and that it lends itself to the use of a locking device which becomes an integral part of the blade construction, being built in between the two blades, thus contributing further to the idea of simplicity. The locking device is a very ingenious patented idea, being so constructed that only a single operation of a standard switch hook is required to both release the lock and open the switch. The design, workmanship, material and finish of this switch are claimed to be the best possible. It is manufactured by the Electrical Engineers Equipment Company.

The Maharajah Adopts Electricity

The accompanying illustration represents an installation of electrical equipment recently made by the Hughes Electric Heating Company in the kitchen of the Palace of the Maharajah of Mysore, India. The holes in the foreground are of the charcoal stoves that were used previously to the installation of electric ranges. The electric equipment consists of the following: Six 3-burner hot plates, four 2-burner hot plates, one cabinet range, two table stoves, six self-contained ovens. This installation has added interest from the fact that chief electrical engineer to the Government of Mysore is Mr. C. F. Beames, formerly manager of the Nipissing Central Railway Company.


THE HUGHES ELECTRIC HEATING COMPANY
CHICAGO U S A
THE ANGLO AMERICAN ELECTRICAL STORES
BANGALORE.

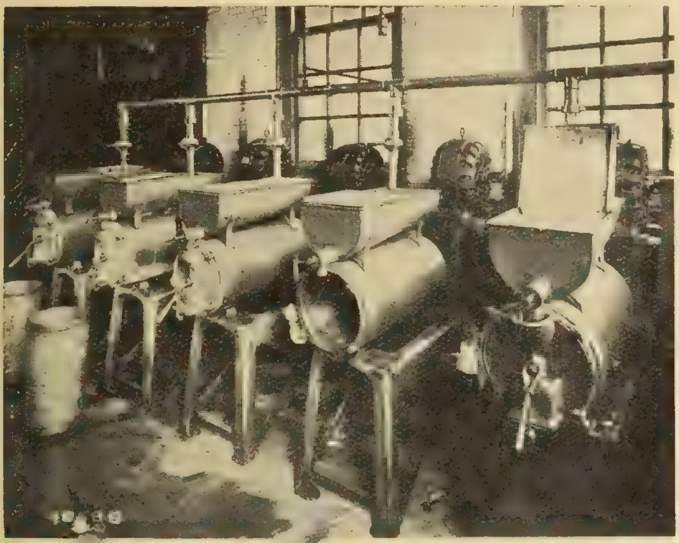
The Canadian Puget Sound Lumber Company have made arrangements to take power from the B. C. E. R. Co. up to 1200 h.p. for their mill in Victoria.

The Application of Electricity to Ice Cream Making

In the scientific manufacture of ice cream in large quantities, electricity is now used very extensively. In a large Philadelphia plant with a capacity to serve 100,000 people a day, that is, say 10,000 quarts of ice cream, a total of seventeen motors with an aggregate capacity of 140 h.p. have been installed. Most of these motors are used for refrigerating purposes, no ice being used except for the preservation of the ice cream in its frozen state during its transportation from the factory to the consumer.

The refrigeration in this plant is produced by a 30-ton refrigerating machine connected by chain drive to a 60 h.p. induction motor. The cream is brought to the factory in sterilized cans, is pasteurized and then forced through slow cooling coils until it reaches the proper temperature, when it is automatically delivered to a silver lined mixing machine. Into this same machine are also poured the other necessary ingredients, including sugar and fruits. This mixture is now thoroughly mixed, the operation being performed by a 10 h.p. motor which also drives the cooling apparatus.

After mixing, the prepared cream is again forced through a series of cooling coils and passed at its decreased temperature into the six 40-quart individual German-silver lined freezing machines shown in the figure. Each of these machines is driven by a 3-h.p. induction motor. The cylindrical freezer is surrounded by a brine jacket, the brine being kept in constant circulation by a pump driven by a 10-h.p. motor. When the cream reaches a consistency which will just permit of its being poured, it is drawn out of the freezers into ice cream cans. The temperature in this latter case is judged by the consistency of the mixture, which is again judged by the amount of current the motor performing the mixing is using. So it is that an ampere meter tells indirectly the temperature of the cream. Electric motors are also used to drive can washers, sterilizers, ice crushers, pumps, elevators and fans. The economy of electrical operation in the manufacture of ice cream over the old fashioned methods is claimed to be very great, to say nothing of the greatly improved sanitary conditions which result from the use of electric drive.



Will Represent Keystone Co.

On and after March 1st, 1913, the old-established house of Surpless, Dunn & Company, of New York and Chicago, will be the direct representatives of The Keystone Manufacturing Company, Buffalo, N.Y., manufacturers of Keystone and Monarch Ratchets, Westcott Wrenches, etc.

New Condulets

Fig. 1 shown herewith represents the type FBL condulet which has been designed by the Crouse-Hinds Company of Canada to meet the requirements of the Association of Railway Electrical Engineers calling for a suitable device to accommodate a 100 to 200 ampere fuse for battery circuits on electrically lighted cars. These condulets are of substantial design and well suited to meet the most severe service. Each is provided with a close fitting, hinged cover with catch, which protects the contents of the condulet from dust and bad weather. In connection with this condulet there is also an adjustable fuse holder for use when it is desired to mount an open link instead of an enclosed fuse. This type of condulet has been specified by the C. P. R. Company for use on their cars now being built by Barney & Smith, of Dayton, Ohio.

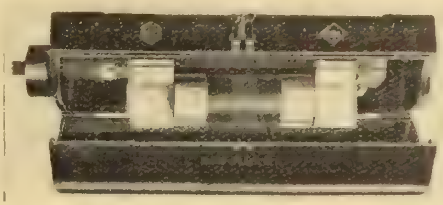


Fig. 1

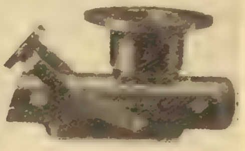


Fig. 2

Fig. 2 represents type TJ condulet for use with telephone jacks and is especially designed for making telephone connections at railway stations. The condulet has a swivel base which is secured to the under side of the car, allowing the body of the condulet to swing around in such a manner that the telephone plug will pull out when the car leaves the station. A hinged drop at one end falls by gravity when the plug is removed and closes the opening into the condulet. An insulating bushing is provided at the opposite end through which the telephone wires pass to the interior of the car. The telephone jack is secured to the inner side of the condulet cover; therefore, to take out the jack it is only necessary to remove the two cover screws, which also gives access to the condulet.

The Crouse-Hinds Company of Canada have also just issued a special bulletin on panels and cabinets specially designed for 250 to 500 volt, Edison three-wire systems with grounded neutral.

The Jefferson Glass Co.

From "sand" to "Luceo" and "Moonstone"—this is the story of the magic transformation that is constantly taking place in the factory of the Jefferson Glass Company, Gerrard St. and Carlaw Ave., Toronto. This factory has only been in full operation for about three months and already every department has settled down to that steady routine which guarantees quality and prompt delivery to the customer. Every equipment essential in the manufacture of the various kinds of useful and ornamental glass has been provided and though, of course, the chief product will be reflectors, globes, etc., for use in electric lighting installations, other forms of glassware are also included. One of the most important sections of the factory is that given over to the manufacture of the numerous moulds required. This section is specially valuable in view of individual requirements of architects or others who may require a special design for any particular installation. This department of the Jefferson Glass Company will manufacture to the specifications of the customer any design of mould required, thus giving to his particular installation an individuality it would be impossible to obtain by purchasing equipment in the ordinary way.

Annual Company Conventions

As indicating methods adopted by one successful business house in handling their sales problems, the following information will doubtless be of interest to our readers:—

Following a long established custom, the salesmen, as well as the department managers, of the H. W. Johns-Manville Company, assembled in annual convention on various dates from January 2nd to February 8th, at Milwaukee, Boston, New York, Philadelphia, Pittsburgh, Cleveland, Chicago, St. Louis, New Orleans, San Francisco, and Toronto, to learn more about the products they sell. One by one about three hundred products of this concern, such as J-M asbestos roofing, shingles, packings, pipe coverings, brake linings, conduit, waterproofing materials, mastic, cold storage insulation, electrical supplies, etc., were taken up and their advantages over competitive products pointed out to the salesmen by specialists in each line. A week's time was devoted to each of these conventions, with a banquet at the close as a fitting ending.

Installing McDougall Pumps

The city of Montreal has awarded to The John McDougall Caledonian Iron Works Company, Limited, of Montreal, a contract for two twelve million Imperial gallon pumping units, at a price of $50,046. The units consist of two 20-inch three-stage Worthington turbine pumps, direct-connected to 750 brake horse-power Browett-Lindley high speed engines, running at 350 r.p.m. and operating against a water pressure of 92 pounds. The three-stage pump of the McDougall company was selected as a type that already had given the city very satisfactory service for a number of years, operating 24 hours per day. This makes the thirteenth pumping unit furnished to the city of Montreal by the John McDougall Company and Henry R. Worthington, aggregating a total pumping capacity of over one hundred million Imperial gallons.

Chapman & Walker in New Building

Chapman & Walker, Limited, electrical engineers and contractors, are now leaving their present premises at 69 Victoria street, and moving into their new building at 118-120 Richmond street west, Toronto. This move has been made necessary by the constantly increasing business this firm is doing. In their new building, which was designed by Messrs. Chapwick & Beckett, they have a showroom displaying all kinds of electrical machinery and fixtures, with large offices at the back. The warehouse is situated in the basement. The freight elevator has been installed by the Roelofson Elevator Works of Galt, Ont.

Messrs. Chapman & Walker hope to be settled in their new building within the next fortnight.

The Hinton Electric Company

An important change recently took place in the Vancouver management of the Hinton Electric Company of Victoria. Mr. J. A. Hinton, who has for years been prominently identified with the commercial life of the capital city, and who is president of the Hinton Electric Company, has taken charge of the local establishment. The company is one of the oldest and most reliable firms in British Columbia, and the presence of Mr. Hinton at the head of affairs ensures continued expansion and progression in its internal affairs

Escher, Wyss & Company, Montreal, have received a contract for a pump for the city of Regina waterworks system, which will have a capacity of 6,250,000 gallons per day. The pump will be driven by a 200 horse-power Belliss and Morcom engine. The contract price for the entire equipment is $16,000.

Trade Publication

P. & S. Bulletin.—No. 766, showing how it is possible to make 24 P. &. S. sockets from fifteen parts.

Pneumatic Tools.—Bulletin No. 124 issued by the Chicago Pneumatic Tool Company, describing their new pneumatic riveting, chipping, calking and stone hammers.

Dossert Connectors.—A reprint from the Signal Engineer of an article on the use of Dossert Connectors in signal work, distributed by Dossert & Company, New York.

Reflectors and Fixtures.—Bulletin I-T, descriptive of Wheeler industrial reflectors and Mazda fixtures for mill and factory lighting, issued by the Canadian General Electric Company.

Greatest Efficiency.—Booklet issued by the National X-Ray Reflector Company, of Chicago and New York, describing their reflectors as being typical of greatest efficiency in reflection of light.

Commutator Cement.—A booklet issued by the Westinghouse Electric & Manufacturing Company, describing a commutator cement for repairing pitted commutators and for filling slots of undercut commutators.

Proper Lamp Voltages.—A discussion of the selection of incandescent lamps for use on circuits having a fluctuating voltage, issued by the engineering department of the National Electric Lamp Association, Cleveland.

L'Ecole Polytechnique.—Bulletin No. 1 issued by L'Ecole Polytechnique of Montreal, describing the operations of that school. Some interesting articles on technical subjects such the "metric system" are included in this number which is published in French.

Railway Operation.—A booklet issued by the Canadian Westinghouse Company, entitled "Economy in Railway Operation." The article is written by Mr. F. E. Wynne, and is a reprint of a paper read before the Baltimore section of the American Institute of Electrical Engineers.

Electric Specialties.—1913 catalogue just issued by the McGill Manufacturing Company, Valparaiso, Ind. This company manufactures electric specialties of all kinds including the well-known Loxon lamp guard, thumswitch trouble finder, lamp frosting fluids, adaptable lamp changer, etc.

Spring Binding Post.—Catalogue No. 1 issued by the Fahnestock Electric Company, Brooklyn, N.Y., descriptive of the spring binding post manufactured by this company. It is claimed that these binding posts are more rapid in their action than other types, make better contact, offer less resistance and require no tools.

Fuel Economies.—A catalogue issued by G. L. Simonds & Company, Chicago, describing the Simonds fuel economy lines. These lines include the Vulcan soot cleaner for water tube and fire tube boilers, the Hays flue gas analysis instrument, the Dean boiler tube cleaner and the Eclipse smoke indicator. This book is a practical treatise on fuel economy in connection with power plant operation.

Electric Power Transmission.—A booklet issued by the British Aluminium Company, outlining the advantages possessed by aluminium over copper in transmission work. A study has been made of the economic and technical aspects of the use of aluminium as a transmission line conductor, and in making comparisons with copper, it is believed that every possible factor influencing the cost has been considered.

Small Motors.—Booklet issued by the Canadian Westinghouse Company, entitled "How Westinghouse Small Motors can Help you." The pamphlet contains suggestions for saving time and labor in homes, hotels, restaurants, offices, stores, shops and on the farm. The same company has also issued a similar booklet entitled "Westinghouse Motors"; this booklet is specially designed to emphasize the fact of the serviceability of motors manufactured by this company.

Current News and Notes

Aurora, Ont.

Professor Herdt, of McGill, has been engaged by the Town Council of Aurora, Ont., to advise on the power propositions submitted by the Hydro-Electric Commission and the Toronto and York Radial Railway Company.

Brandon, Man.

The new street cars are expected to arrive not later than March 1st.

Chatham, Ont.

It is reported that Mackenzie & Mann interests have purchased the controlling interest in the Chatham, Wallaceburg and Lake Erie Railway Company.

Fort William, Ont.

Manager Farquharson, of the light and power department, advocates the sale of power for electric cooking purposes at the reduced rate of 1½c per kw. hour. The present rate for this purpose is 3c per kw.h., but it is argued that any extra current sold at the off-peak hours would be clear gain. The only difficulty that might arise would be the increase of the peak load by the introduction of a large number of cooking appliances.

Fredericton, N.B.

There are reports that the Fredericton Street Railway Company who secured a charter for a street railway system here three years ago, are reviving the question, and that there is a possibility of the road being built at no very distant date.

Galt, Ont.

The first annual report of the Waterloo Township Municipal Telephone Association shows that the trunk line covers 43 miles, has 250 subscribers and that the cost per phone is approximately $6. The system will be extended to the west side of the Grand River and also to New Germany, and probably to Woolwich township. When these extensions are complete, it is expected that the system will include five hundred subscribers.

Glencoe, Ont.

An hydro-electric system is planned, power to be taken from the Hydro-electric Commission of Ontario.

Guelph, Ont.

The matter of the purchase of some new cars for the Guelph railway system was recently discussed by the Board of Management. It was the general opinion that new cars will be required during the coming summer, and it is reported a by-law may be submitted for authority to raise the necessary funds.

Halifax, N.S.

In the speech from the throne at the opening of the Nova Scotia legislature, it was forecasted that a grant would be made this session for the construction of rural telephone lines.

Hamilton, Ont.

Tenders will be called shortly for equipment for transformer station.

The Board of Control has ordered new plans to be prepared for the electric pumping station. Building, complete with equipment, will cost $70,000. Pumps and motors required.

London, Ont.

It has been announced that three new hydro-electric distribution lines will be built out from this city during the next summer to serve that number of agricultural districts and the towns and villages therein.

Street lighting extensions to the number of approximately 270 lights will be installed in the outlying sections in the near future.

Montreal, Que.

The membership of the Montreal Electrical Society is now over 350, the increase being due to a contest between two sides—the Volts, who put in 112 applications, and the Amperes, who made 92 applications. It has been decided to hold a dinner at the end of March, the entertainment at which will be supplied by the Amperes, the losing side in the contest.

Moose Jaw, Sask.

One of the promoters of the Regina to Moose Jaw interurban railway is reported to have stated that the company's intention is to have the railway in operation by the end of the present year. It is said that the company will use gas electric cars.

Nanaimo, B.C.

Recent advices from Nanaimo state that the Nanaimo Electric Light & Power Company intend to extend the electric lighting system out to Five Acres, a suburb of that city. An order for the necessary equipment has already been placed and it is expected that the work will be commenced in April and completed before next winter.

Ottawa, Ont.

The Niagara, St. Catharines & Toronto Railway Company have been granted a two-year extension of time for the construction of their lines from Port Colborne to Fort Erie to Niagara Falls, and also for the line to Toronto.

Oxbow, Sask.

Electric lighting plant to cost $12,000, is contemplated

Porcupine, Ont.

The second unit at the Wawatian Falls, Que., has been brought into use, bringing the capacity of the plant up to about 4,500 horse power. This will insure to the Dome and neighboring mines all the power they require.

Portage la Prairie, Man.

A charter has been granted the Portage la Prairie Radial Railway Company to construct and operate an electric railway system. It is provided that the railway must be commenced within two years and completed within four years.

Regina, Sask.

A by-law was submitted on February 24th to expend $454,086 on extensions to the municipal electric light system.

A by-law was submitted on February 25th to provide for the expenditure of $125,000 in connection with the Regina General Hospital. This is understood to include the installation of a private power plant.

River Glade, N.B.

Tenders were called up to February 20, by Architect F. N. Brodie, St. John, N.B., for the erection of a concrete power house in connection with the Jordan Sanitarium. The capacity of the equipment to be installed is approximately 300 horse power.

St. John, N.B.

The International St. John River Commission held an important hearing in St. John, N.B., recently, at which the matter of the erection of a large dam for the generation of electric power by the St. John Hydro-electric Company was taken up. Prominent men in the lumbering industry and representatives of the fishing interests gave evidence before the commissioners. The representatives of the fishing interests were unanimous in opposing the scheme, but the opinions of the lumbermen varied greatly, some expressing the belief that a proper regulation of the river would assist a passage of logs while others opposed the scheme, believing it would delay the handling of their material.

Sarnia, Ont.

It is understood the prices quoted by the Commission for power in Sarnia are as follows: 3,000 h.p. at 13,000 volts, $41 per h.p. year. If up to 5,000 h.p. are taken, this price would be reduced to $31 per h.p. year.

Saskatoon, Sask.

A power rate of 1½c per kw.h. for a 24-hour load has been quoted the Western Canada Flour Mills Company on a 500 horse power basis.

Stratford, Ont.

Equipment is required for extensions to the electric lighting system.

Swift Current, Sask.

Additions to power house to develop 200 horse power are reported to be planned. By-law will be submitted about March 15.

Toronto, Ont.

The Court of Appeal has handed down a decision in the city's appeal from the order of the Ontario Railway and Municipal Board approving the Toronto and York Radial Railway Company's plans for the deviation of their line at Farnham avenue on Yonge street north. The decision of the Court of Appeal is that the company have no right to cross the streets without the consent of the city. The company have already spent a large sum of money in purchasing the right-of-way, excavating and laying part of the track.

As the result of a conference between the Hydro-electric Power Commission of Ontario and a large number of electrical contractors, jobbers and manufacturers, a committee of the latter will confer with the engineers of the commission on the new code of wiring rules to be adopted in Ontario. At the present time the original draft of rules is being revised and a few advance copies will be distributed among those interested, after which any points at issue will be discussed. It is understood that Mr. Beck assured the deputation that the new rules would not conflict with the National Code already in force in Ontario.

Vancouver, B. C.

The Cariboo Power Company, Limited, was recently incorporated with a capital of $250,000, with head offices at Vancouver, B.C. The usual licenses were applied for.

The plans of the recently organized Vancouver Island Hydro-electric & Tramway Company are said to include the construction of a tramway from Nanaimo to Nanoose and Departure Bay on Vancouver Island. It is understood that these two branches of 16 miles and 3 miles respectively, are to be part of a scheme to construct 200 miles of road in the Nanaimo district.

Victoria, B.C.

The Portland Cement Construction Company's plant at Bamberton is nearing completion. The B. C. E. R. Co. will supply the necessary energy up to 2500 h.p.

Most of the offices in the Victoria City Hall are now heated by electricity. This class of business as well as electric cooking, has a very strong hold in Victoria.

Contracts for 1913 supplies have been awarded as follows: Solid carbons and cored carbons, the Northern Electric & Mfg. Company, 313 Water street, Vancouver, at $19.25 per M. and $19.70 per M. 1440 glass ball globes at $10.50 per doz. and 100 glass ball globes of different sizes at $18 per doz., the Can. Gen. Elec. Co., 1065 Pender St. W., Vancouver.

Welland, Ont.

Petitions are being circulated in Stamford township to secure the erection of a hydro-electric distribution system. This is an unusually thickly settled township, also containing a number of factories.

Winnipeg, Man.

Erection of power sub-station No. 3 to take the form of an annex to the terminal station on Rachel street is contemplated.

Escher Wyss & Company, Montreal, have been awarded the contract for the manufacture and installation of three water wheels and governors of 6,800 h.p. capacity each, for the extension of the city of Winnipeg's power station at Point du Bois.

Tenders for Supplies

Sealed tenders, registered and clearly marked on the outside of envelope, "Tenders for Electrical Department Supplies," and addressed to the City Commissioners, Regina, Saskatchewan, will be received up until noon of **March 29th, 1913**, for the supply of:—

Section No. 1.—Weatherproof copper wire.
Section No. 2.—Western cedar poles.
Section No. 3.—Cross-arms.
Section No. 4,—Top-pins, insulators, etc.
Section No. 5.—Pole line hardware.
Section No. 6.—Pole type transformers.
Section No. 7.—Integrating watt meters, single, polyphase and two rate.
Section No. 8.—Metal flame arc lamps and station equipment.
Section No. 9.—Series cut-out mast arms for arc lights.
Section No. 10.—Underground material.
Section No. 11.—Fire alarm boxes and gongs.
Price to be F. O. B. Regina.

Copies of specifications may be had from E. W. Bull, Superintendent of Light and Power, Regina, Sask.

A marked cheque covering 5 p.c. (five per cent.) of bid must accompany each tender.

The City Commissioners reserve the right to reject any or all tenders.

E. W. BULL,
Superintendent of Light and Power.

5-6

Moonlight Schedule for March, 1913

Courtesy of the National Carbon Company, Cleveland.

Date.	Light.	Date.	Extinguish.	No. of Hours
Mar.1	6 20	Mar.2	5 20	11 00
2	6 20	3	5 50	11 30
3	6 20	4	5 50	11 30
4	6 20	5	5 50	11 30
5	6 20	6	5 50	11 30
6	6 30	7	5 50	11 20
7	6 30	8	5 40	11 10
8	6 30	9	5 40	11 10
9	6 30	10	5 40	11 10
10	6 30	11	5 40	11 10
11	6 30	12	5 40	11 10
12	6 30	13	5 30	11 00
13	10 40	14	5 30	6 50
14	11 50	15	5 30	5 40
16	0 50	16	5 30	4 40
17	1 50	17	5 30	3 40
18	2 30	18	5 30	3 00
19	3 10	19	5 20	2 10
20	No Light	20	No Light	
21	No Light	21	No Light	
22	No Light	22	No Light	
23	6 40	23	9 30	2 50
24	6 40	24	10 50	4 10
25	6 50	26	0 10	5 20
26	6 50	27	1 50	7 00
27	6 50	28	2 20	7 30
28	6 50	29	3 20	8 30
29	6 50	30	4 10	9 20
30	6 50	31	4 50	10 00
31	6 50	Apr.1	5 00	10 10
			Total...........	226 00

SIEMENS

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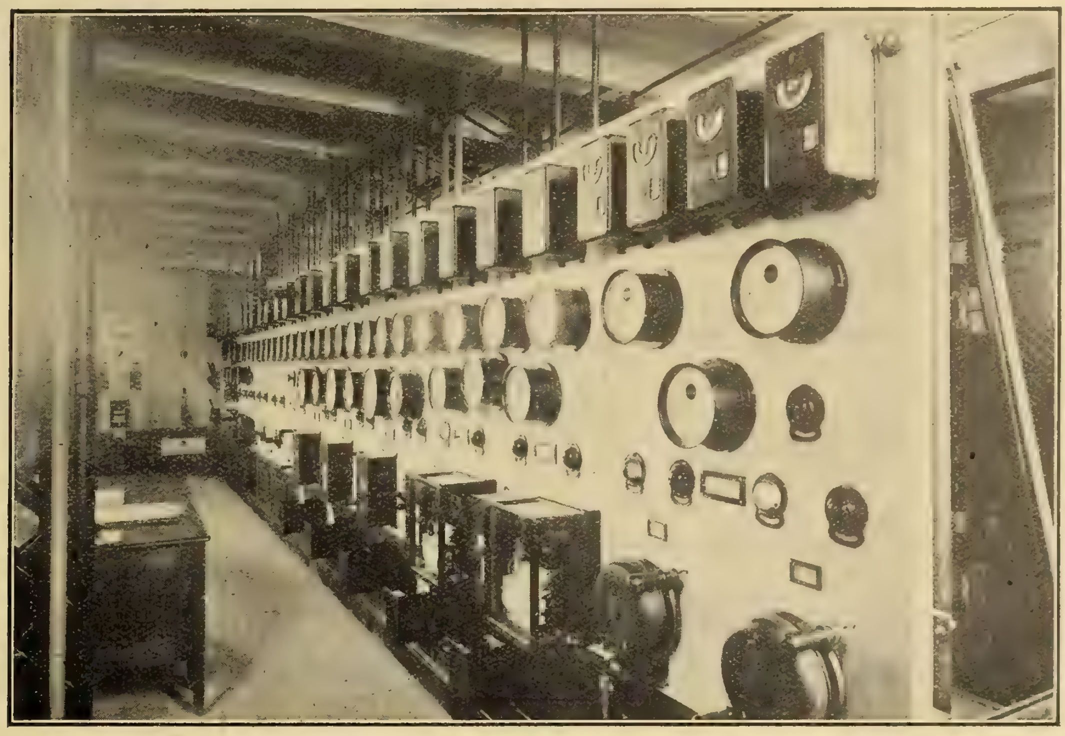

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We supplied the complete sub-station equipment, consisting of 7-750 K.V.A., 22,000 volt transformers, switchboard shown above, lightning arresters and 2-750 H.P. motors generators.

Half the foregoing was a repeat order after our apparatus had been in satisfactory operation for 18 months.

We undertake the complete equipment of electrical plants of every description up to and including 110,000 volts.

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5

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The Vacuum Car Ventilating Company has commenced manufacturing Mechanical Car Ventilating Systems under Canadian Patent No. 128070, dated September 13, 1910, and is prepared to furnish same on demand. For detailed information and prices, address Lock Box No. 25, Windsor, Ont. 10-t.f.

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Tenders for the Power-House Equipment

Sealed tenders registered and clearly marked on the outside of the envelope "Tenders for the Power House Equipment," and addressed to the City Commissioners, City of Regina, Sask., Canada, will be received up to noon, **March 15th**, 1913, for the supply of:—

BOILERS

Six 500 h.p. water tube boilers complete with mechanical stokers and internal superheaters for 200 lb. pressure and 125 deg. Fahr, superheat.

FANS AND STACK

Two 133,000 cu. ft. per min. 3/4 or 7/8 housing, induced draught fans arranged to discharge through one vertical stack, 12 ft. in diameter and 70 ft. high above base of fans.

Price to be on equipment erected on foundation, built by the City of Regina, to contractors' requirements.

Copies of specifications may be had from E. W. Bull, Supt. of Light and Power, Regina.

A marked cheque covering five per cent. of the amount of bid, made payable to the City Treasurer, City of Regina, must accompany each tender.

The City Commissioners reserve the right to reject any or all tenders.

E. W. BULL,
4-5 Superintendent of Light & Power.

FOR SALE

Stromberg Carlson Telephone Switchboard, capacity five trunk and ten intercommunicating lines; one trunk and four intercommunicating at present connected; four private line Bell sets; everything in A1 condition and only used two months. For further particulars write The Dominion Illuminating Rental Company, 342 Yonge street, Toronto, Ont. 5

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Sales Engineer:—Large Electric Manufacturing Company wishes to employ two young men in the Machinery Sales Department, college training and shop experience required, selling experience not necessary, but such experience will be given extra consideration. Apply Box 706, Electrical News, Toronto, Ont. 4-5

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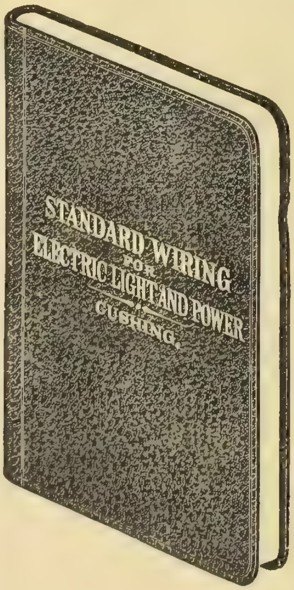

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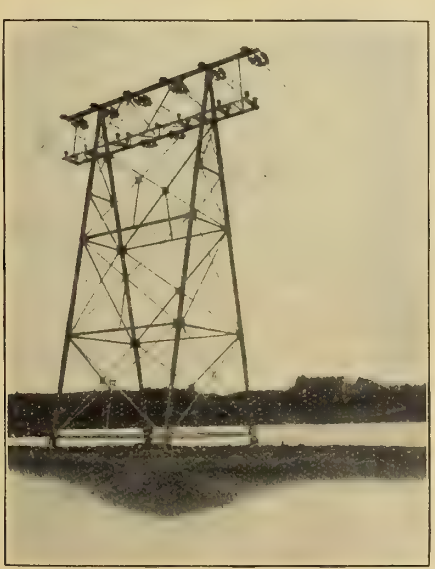

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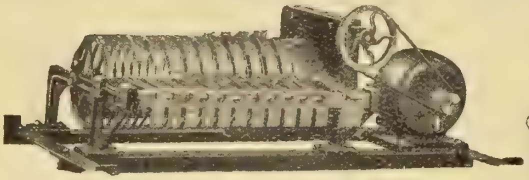

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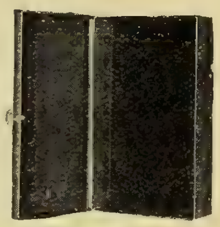

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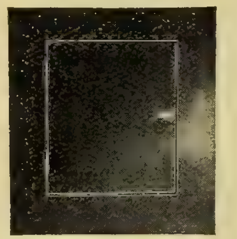

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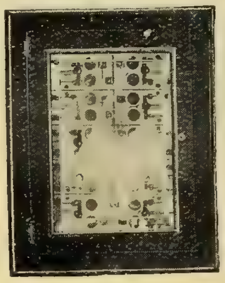
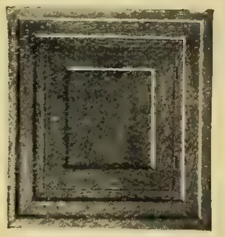


Type G. With a beveled plate glass panel in door.



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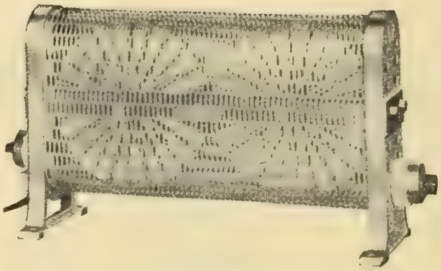

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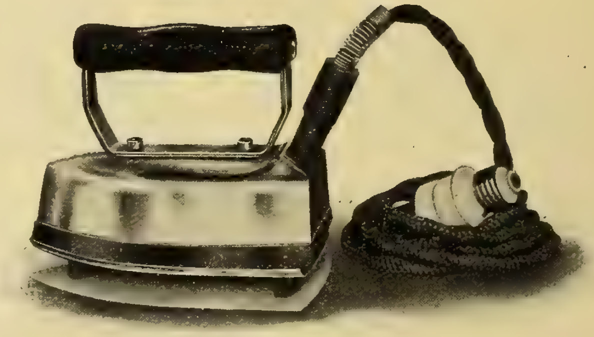

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In addition to the iron and radiator illustrated here, the "Economic" line includes Disc Stoves, Water Urn Heaters, Tailors' Irons, Car Heaters, etc. *Send for prices and particulars.*

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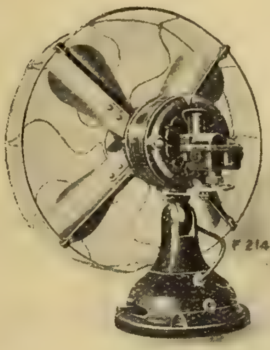

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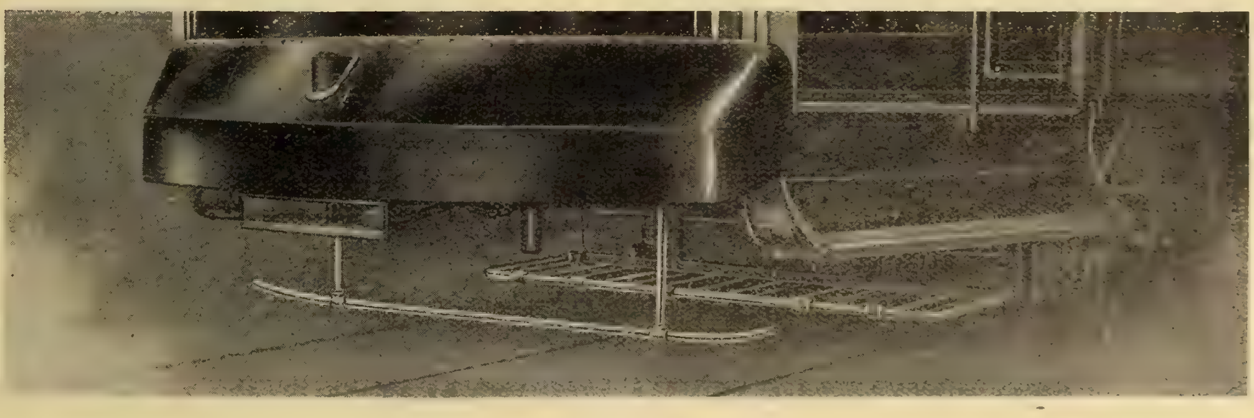

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Arrangements for the manufacture of these wheel guards have been made with the Schofield-Holden Machine Co., Ltd., Toronto, Canada, under Canadian Patent No. 131,381 Dated Feb. 28, 1911 and can be seen in operation at their factory 2 Carlaw Ave., Toronto. For further information address

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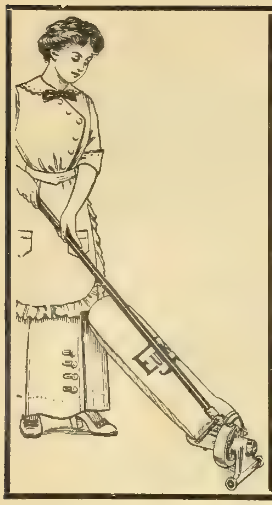

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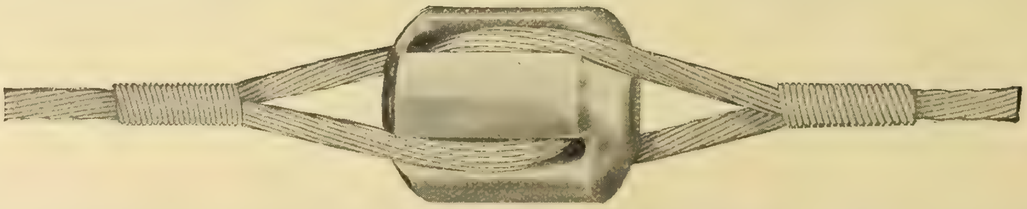

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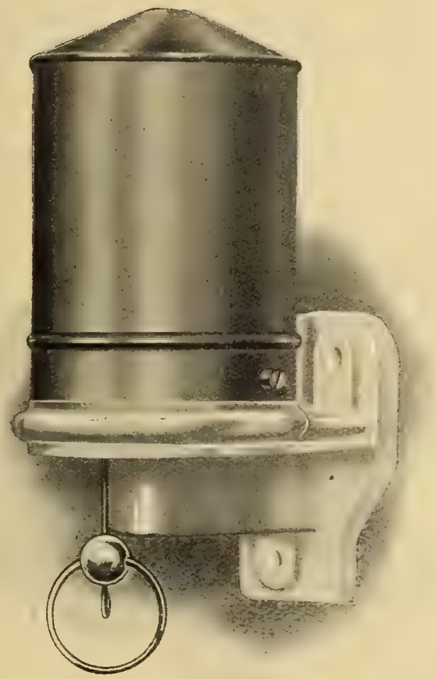

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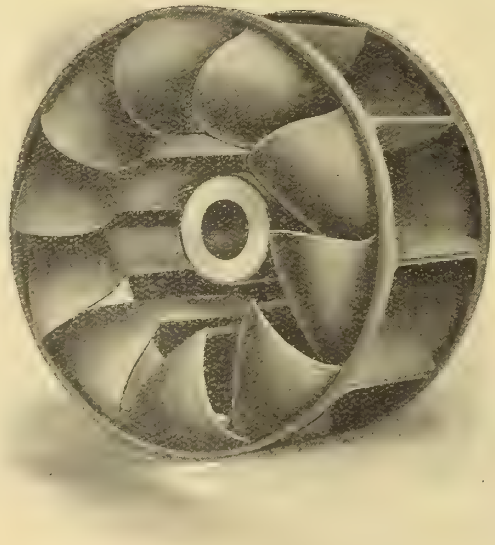

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A very high-grade of friction tape, having high insulation, great adhesion and being moisture-proof. It will not dry out.
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1/2 POUND
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MONTREAL TORONTO WINNIPEG REGINA CALGARY VANCOUVER

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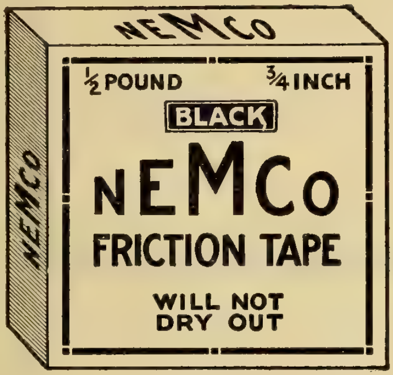

Your orders for electrical supplies of any kind will receive prompt and satisfactory attention at any of our branch houses.

The size and completeness of the stock carried at all our branches and our splendid shipping facilities guarantees this.

Northern, Grade A is a friction tape of extra high quality. It insures proper insulation; has extra strong adhesion and is moisture-proof.

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Soldering material of all kinds used in electrical work is carried at all our branch houses. We have also a complete stock of soldering tools including Torches and Fire Pots in several different styles.

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Manufacturer and Distributor of Telephone and Fire Alarm Apparatus and Electrical Supplies for every possible need

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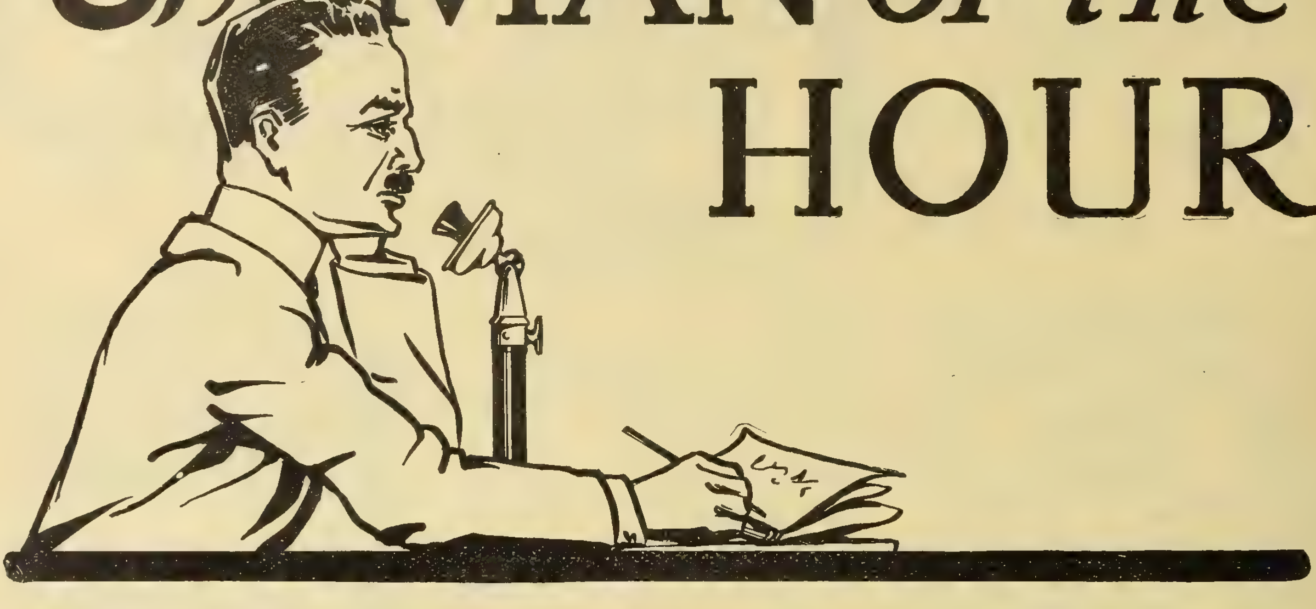

He TELEPHONES instead of writing, walking, or riding, whenever he can, therefore saves energy and doubles his efficiency.

The more subscribers can be induced to telephone the greater will be the demand for your service and new contracts.

The better the telephones, the greater inducement to use them, and the better the service, the greater the need of it becomes. Here is where really fine equipment is the best possible directory builder.

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The highest class telephone service known to the telephone field today is exemplified in the Kellogg equipment. Every part in its construction is sound.

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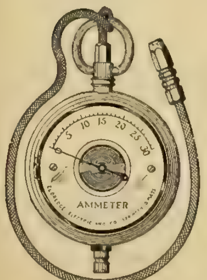

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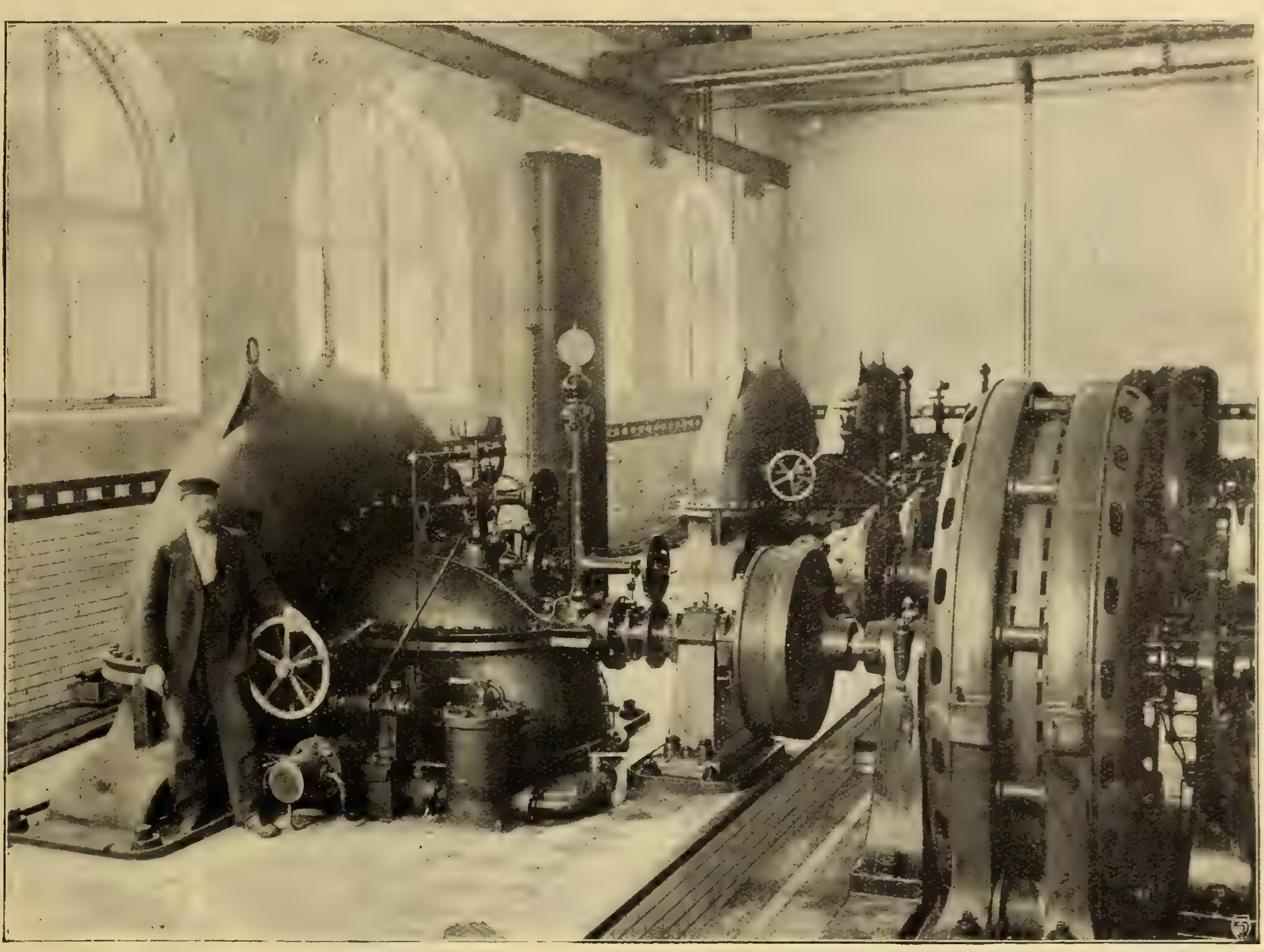

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Net head 42 metres. Three generator turbines each 900 B. H. P., normal speed 500 r. p. m. Two exciter turbines, output 500 B. H. P. each, normal speed 800 r. p. m.

The supply pipe runs in a trench underneath the machine room, and the water is conducted in smooth waterways into the spiral casings of the turbines. The turbines have automatic governors worked by water pressure.

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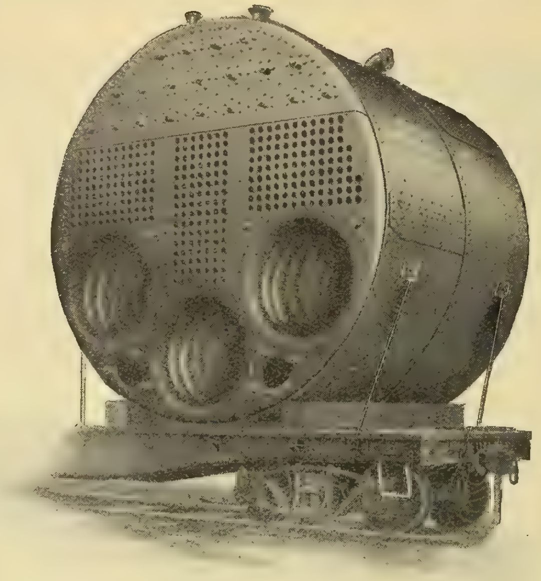

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Motor Generators for All Purposes

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Motor Generators for all conditions of service also a type specially designed for Cinematograph Work

Special designs executed for special requirements

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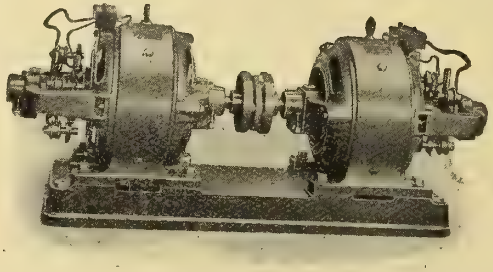

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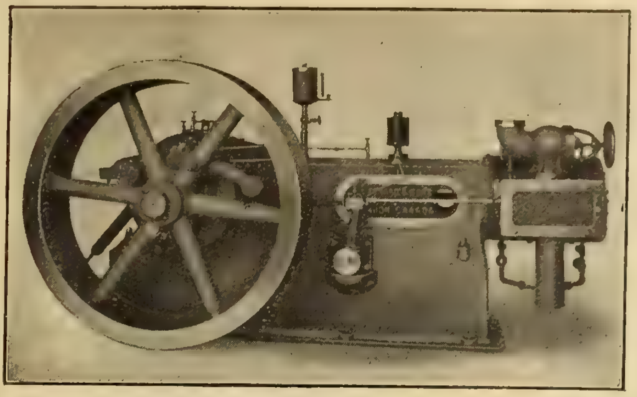

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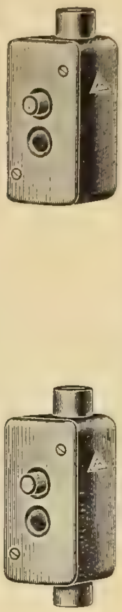
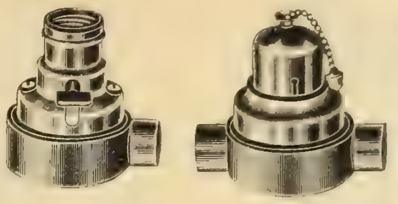
Made of No. 14 guage cold rolled steel—practically unbreakable. The most modern conduit fittings. Made for open work conduit wiring. Let your workmen use them just once—they will ask for them always thereafter.



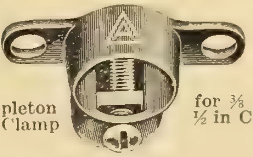
Push Button Switch Unilets Pat. Applied for.



Type No. 1 with key receptacle attached.

Type No. 2 with pull socket attached.

Snap Switch Unilets, Pat. Applied for.



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for ⅜ in. and ½ in Conduit.

Rectangular Unilets. Made in all types and sizes for ½ in to 2 in conduit

Everyone doing conduit work should have our new catalog. Write at once.

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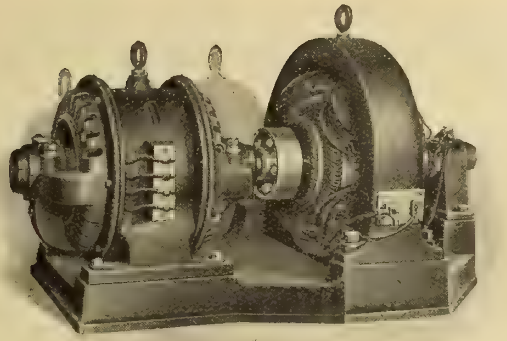

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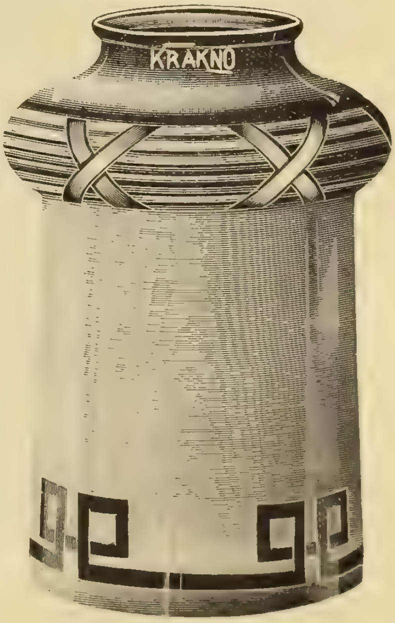

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It will pay you.

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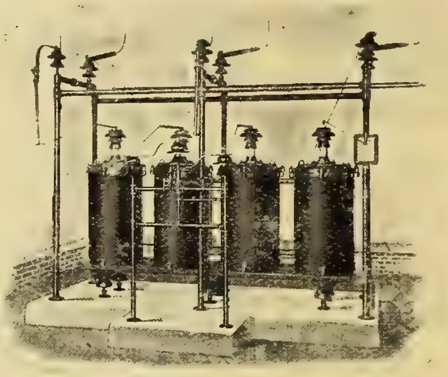
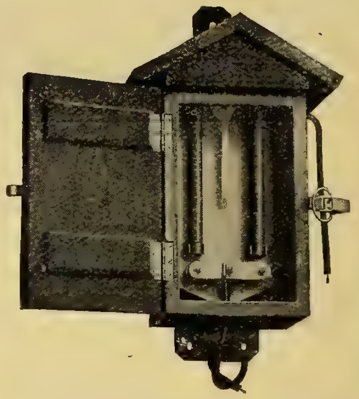
Provide Protective Apparatus For Summer Storms

Type M P Lightning Arrester, Alternating and Direct Current, 400—750 volts



Type A Electrolytic Arrester Alternating Current



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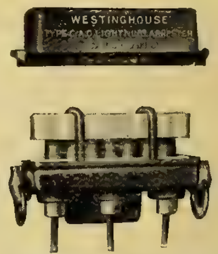
Reliable protective devices may be had at a nominal cost when compared with the possible loss resulting from its absence, due to damaged apparatus and interrupted service.



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Westinghouse Lightning Arresters

are safe and reliable. Do not experiment with untried devices, secure adequate protection by using reliable Westinghouse Lightning Arresters. They are made in types and capacities to meet every condition. They have no moving parts; give long service without replacement; are easy to inspect and are moderate in price.

State your conditions and we will tell you the arrester, or combination of arresters best suited to give you reliable protection. Our suggestions will not obligate you in any way. Consult our nearest office.

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AND REMEMBER We have the Best Equipped Repair Dept. in the Province.

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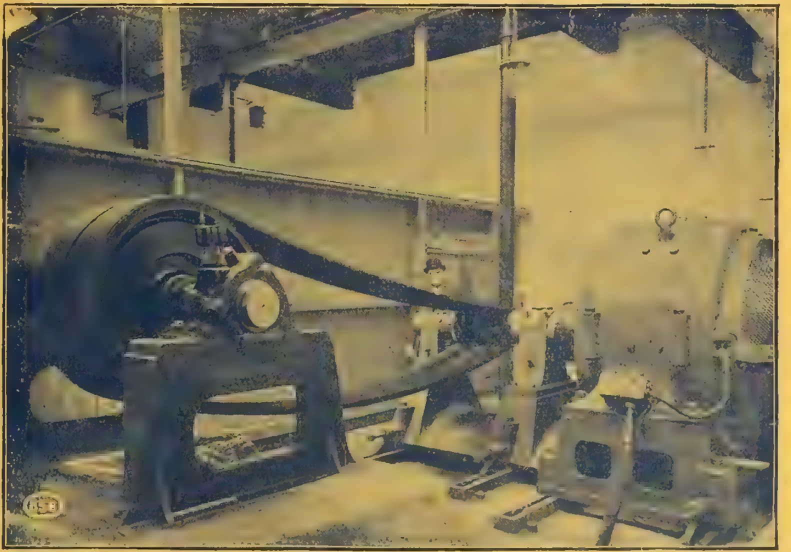

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Absolutely Reliable

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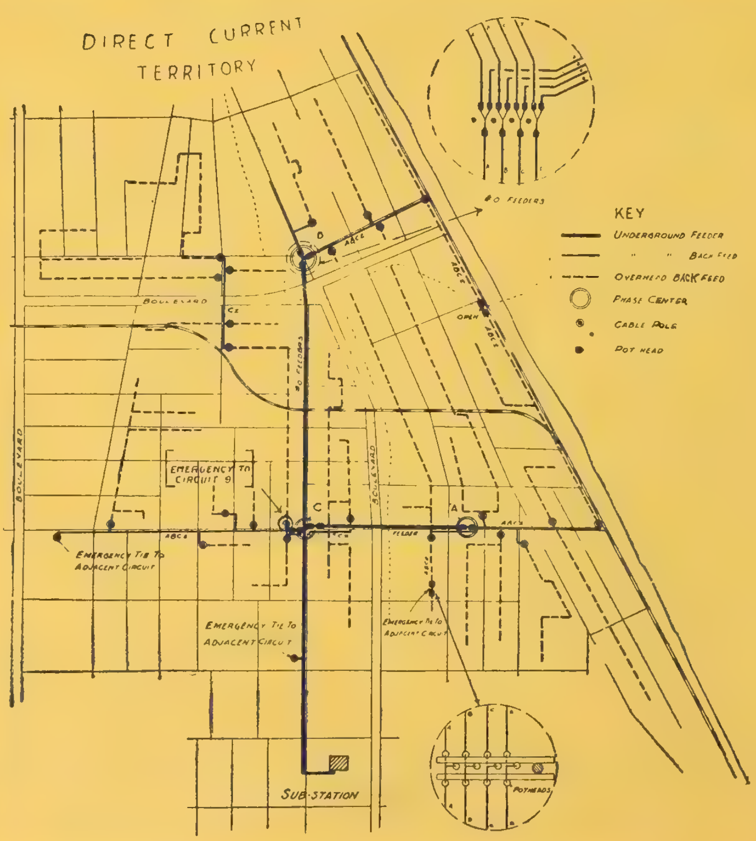

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NO cutting and re-splicing of cables to locate trouble on this circuit. Drawing shows actual circuit arrangement where G & W POT HEADS are used. Highest degree of practicability and reliability for cable-seals and emergency switching.

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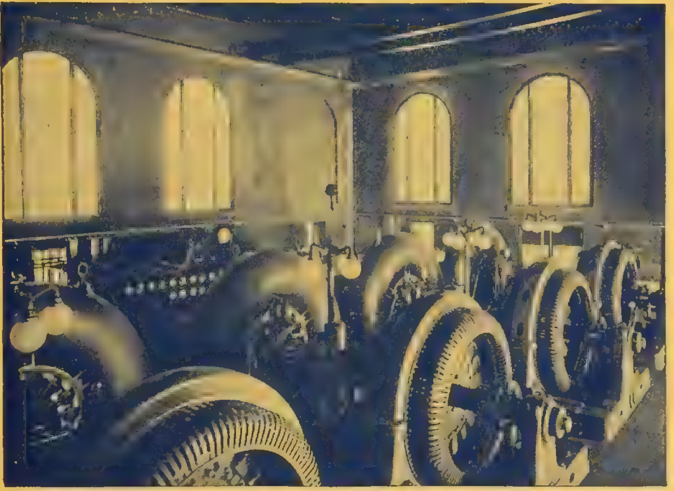

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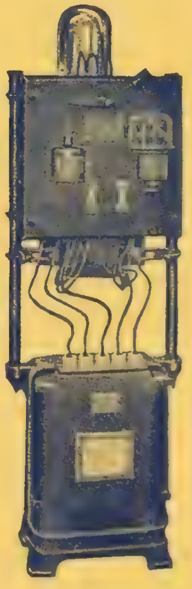

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Mercury Arc Rectifiers

Provide the ideal method of obtaining Direct Current from Alternating Current Services.

RELIABLE AND EFFICIENT
SIMPLE TO OPERATE
ALWAYS READY FOR USE
CLEAN AND COMPACT
NO ROTATING PARTS
NO VIBRATION

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Alphabetical Index to Advertisers, Page 8

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Reliability
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Our new Catalog C-21 lists many new "Canadian Made" devices. Your name should be on our mailing list.

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Benjamin Electric Mfg. Co.
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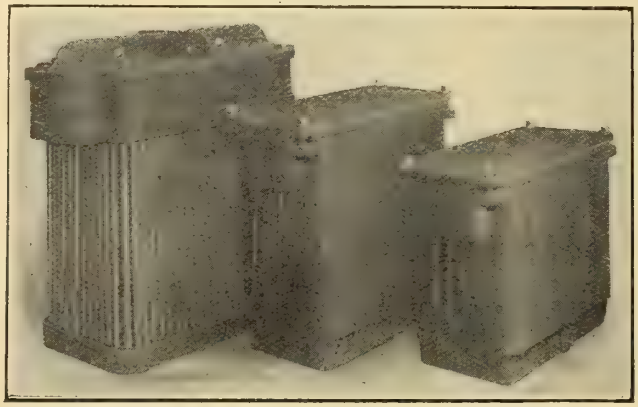
FERRANTI

Transformers

Meters



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THREE phase pole oil immersed transformers have been proved the most satisfactory and efficient type. They effect a great saving in construction costs and reduce operating costs to a minimum.

In Ferranti high efficiency transformers all coils are wound with copper of ample sectional area, thereby reducing copper losses to a minimum. They are designed along simple and substantial lines and all parts are easily accessible.

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Motor Starters
Ammeters and Voltmeters
Portable Power Factor
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Simplicity of construction.
Perfect accuracy.
Cyclometer or clock dials.
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Prompt deliveries.
Every meter carefully inspected before shipment.
Absolutely guaranteed.
Send us your probable meter requirements and let us make you a proposition.
Large stock and fully equipped repair and erection Shops at Toronto and Winnipeg.

The Ferranti Electrical Co. of Canada, Ltd.

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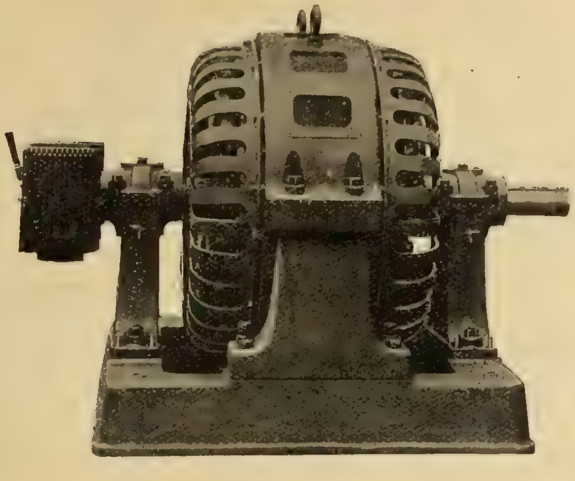
90 Sherbourne St.

WINNIPEG
56 Albert St.



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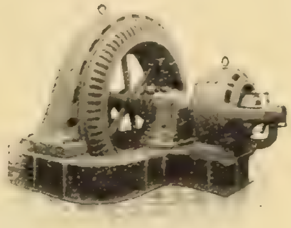

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Fedram Wire Drawn Tungsten Lamps

will give you service and efficiency.

Federal "A" Grade Carbon Lamps

are closely rated as to voltage, candle power and efficiency.

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Let us quote you prices. It will save you money.

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Monarch Electric Co., Ltd.

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Phone Main 3988 Montreal Exchange **District Montreal**

A few of the Monarch Canadian Made Specialties manufactured in this, our own building, are:

Sockets—Rosettes—Attachment Plugs
Lamp Guards—Knife Switches

Oil Circuit Breakers
Switchboard Accessories
Switchboards
Transformers for Instruments

Some Facts About

Northern-Electric

Sturtevant

REG. U. S. PAT. OFF.

Vacuum Cleaners

The suction in the Northern-Electric Sturtevant Vacuum Cleaner is produced by the fan principle. This is the principle on which a vacuum is created when used for high power purposes. A fan that makes thousands of revolutions per minute produces volume and evenness of suction.

Fan-made suction is continuous and even—never jerky. The revolving fan receives little wear and tear. It does not leak. A pump, however, is wrenched and ground at every plunge and soon loses its efficiency on account of leakage.

The vacuum cleaner illustrated, is designed to operate from an ordinary electric lamp socket. The equipment supplied with it includes a 12-foot rubber hose; a 20-foot electric cord with plug and switch and five different nozzle attachments.

Illustrated literature that fully explains all about Northern Electric Sturtevant Vacuum Cleaners will be sent you on request. Write our nearest branch house.

THE Northern-Electric

AND MANUFACTURING CO. LIMITED

Manufacturer and Distributor of Telephone and Fire Alarm Apparatus and Electrical Supplies for every possible need

MONTREAL HALIFAX TORONTO WINNIPEG REGINA CALGARY EDMONTON VANCOUVER

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The Conduit that is specified for Canada's largest buildings, grain elevators and factories.

"Galvaduct"

The Most
Perfect
Interior
Construction
Conduit
on the
Market

Recognized
as the
Standard
of High
Quality

"Loricated"

A High-Class
Interior
Construction
Conduit
of the
Enamelled
Type

Proof
Against Acid
or other
Corrosive
Agents

Ritz Carlton Hotel, Montreal
A "Galvaduct" Building

Always use "Galvaduct" or "Loricated" to carry your wiring and you will have protection and good service.

If Your Jobber Cannot Supply You, Write Us

Conduits Company Limited

Toronto and Montreal

The Lachute Shuttle Co., Limited

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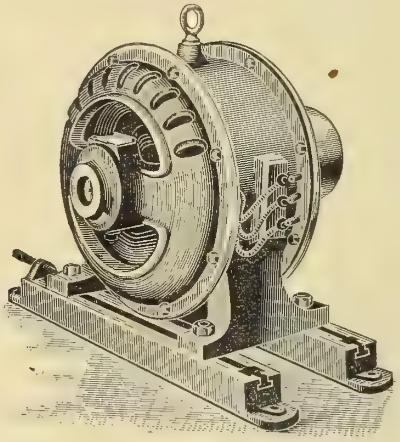
Manufacturers of

Cross Arms—Space Blocks—Birch and other Hardwood Insulator Pins and Brackets.

Use Good Motors

to drive your factory



Such as are manufactured by

Toronto & Hamilton Electric Company

HAMILTON

Have you any repairs? Write us

DRAWN STEEL

UNILETS

RECTANGULAR STEEL UNILETS

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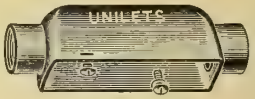

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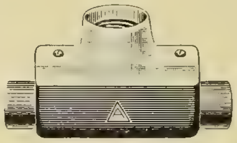

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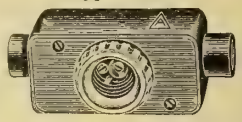

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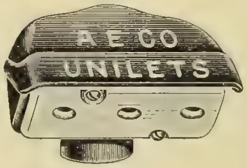
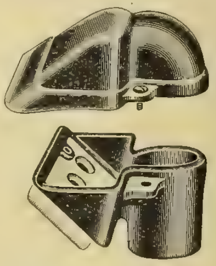


Front view showing 3-wire cover attached



Top part removed

Everything needed by the Contractor in the way of conduit fittings is included in the

Appleton Line

and is described and listed in the No.6 Appleton catalog Send for copy at once and have first hand information about

UNILETS

the ideal outlets for concealed or exposed conduit work and about other Appleton specialties needed for up-to-date conduit work.

Write for the catalog today

Appleton Entrance Unilets—Black, Enamel or Sherardized Finish. Top part removed while drawing wires and making connections. Absolutely waterproof for ½ ihch to 4 inch conduit.

APPLETON ELECTRIC CO.

212 North Jefferson St. - - CHICAGO, ILL.

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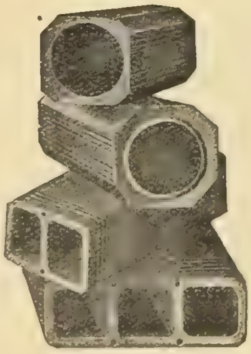
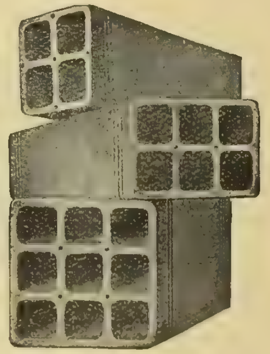


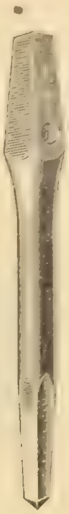
Clermont Sewer Pipe Co.

Multiple and Single Duct Conduit for Underground Work

We challenge the world on finish and durability of our material. Our plant is located giving us the lowest freight rates to Canada.

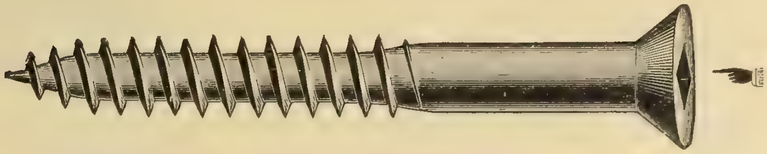
B. S. BARNARD, Vice-Pres. **50 Church St., New York City**





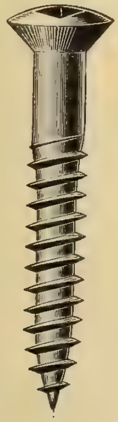
ROBERTSON SOCKET HEAD

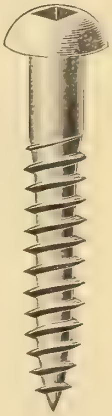
WOOD SCREWS



SEE
THAT
SQUARE
HOLE

PAT. FEB. 2. 1909





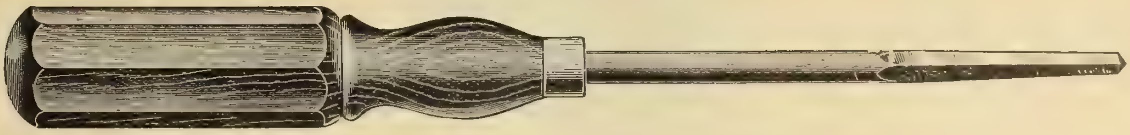
THIS IS A REAL WOOD SCREW

It is driven by a specially designed screw driver which fits snugly into the square hole in the head and there it stays until the work is done. This is the only wood screw of its type on the market and is especially adapted to all work connected with electrical wiring, fixtures, etc.

TRY IT

Place the screw on the driver, then you may reach out at arms length and drive it with one hand. For overhead work, or work between joists or under flooring it is invaluable. Saves time, labor and material. We make the drivers in all suitable styles.

Our Goods are Guaranteed ***Our Prices are Right***



Samples, Prices and Catalogues on Application

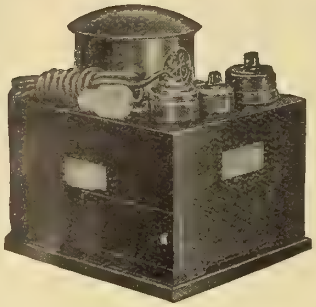
The P. L. Robertson Manufacturing Co., Limited

Milton, Ontario

TORONTO WAREHOUSE,
Ontario Metal Products Co., 102 Front St. East.

AGENTS FOR ALBERTA
TEES & PERSSE, of Alberta Ltd., Calgary, Alta.

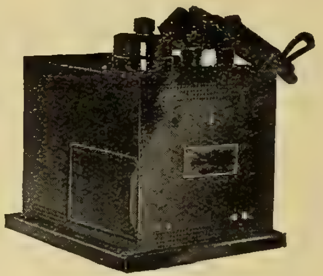
C. G. E. OZONATORS



Household Ozonator
Power Consumption Approximately 15 Watts

Perfect Your Blower Ventilating System by the Use of a C. G. E. Ozonator.

The most effective aid to Ventilation.



Utility Ozonator
(Direct Current)
Power Consumption Approximately 12 Watts

Healthful fresh air a universal necessity.

Is the value of fresh air fully recognized?

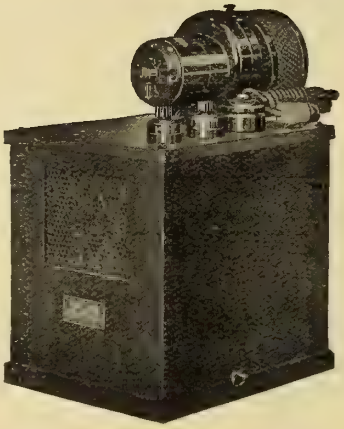
FRESH AIR "MADE TO ORDER"

Impure air is the principal drawback to city life.

The Ozonator is an epoch making invention. Take advantage of it.

"Improvement"

The watchword of industrial progress. Improve your ventilating systems. Use fresh pure air and increase the efficiency of your staff and make your place of business pleasant for your customer.



Universal Type

"Ozonators"

For large or small stores, offices, schools, restaurants, banks, hotels, clubs, cafes, kitchens, factories, theatres and moving picture shows. Destroys the odor of cooking, tobacco smoke, etc.

Write Our Nearest District Office for Information and Prices.

Canadian General Electric Co., Limited

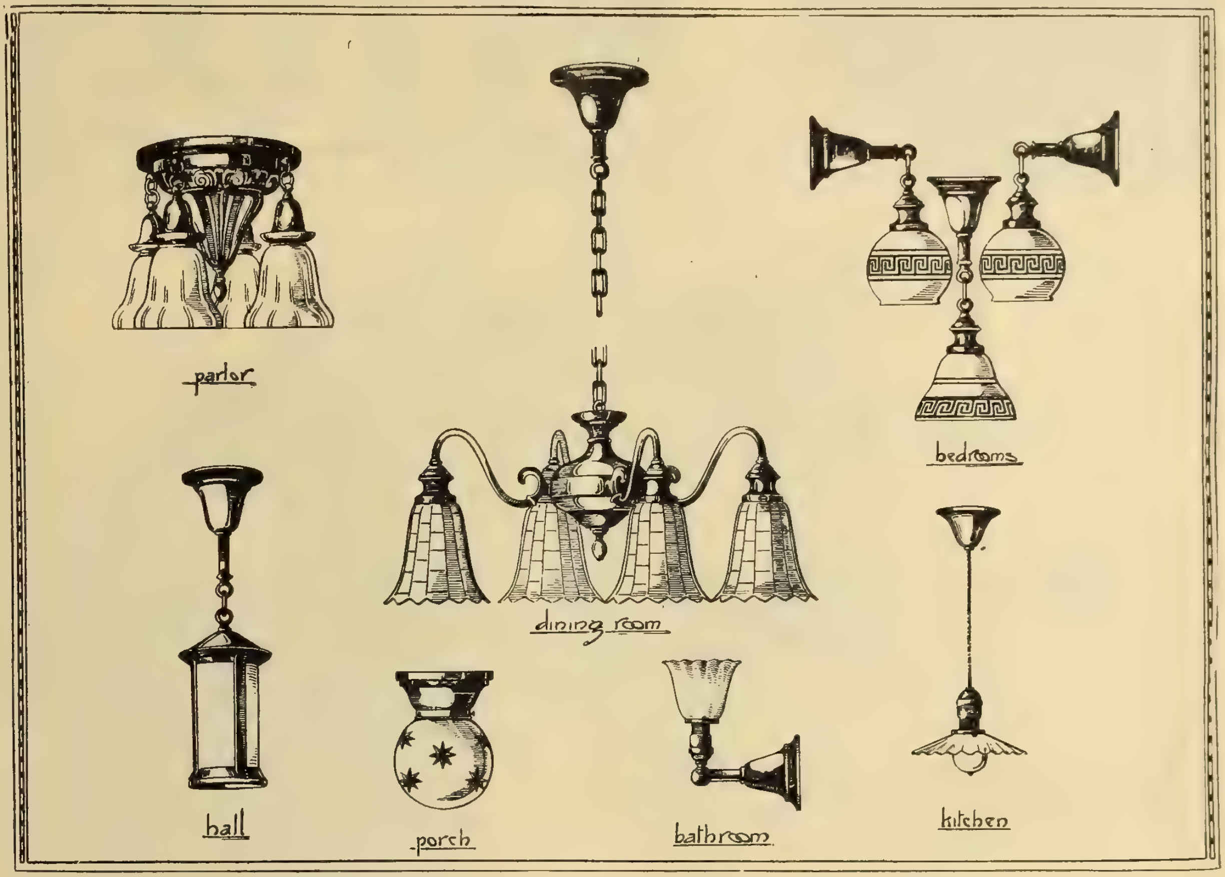
Head Office: TORONTO

Montreal Halifax Ottawa Cobalt Porcupine Winnipeg Regina Saskatoon
Calgary Edmonton Vancouver Victoria Nelson Prince Rupert

A New Tungstolier Idea

De Luxe Set No. 1

9 Fixtures, all wired complete—less lamps and glass
Packed in one box



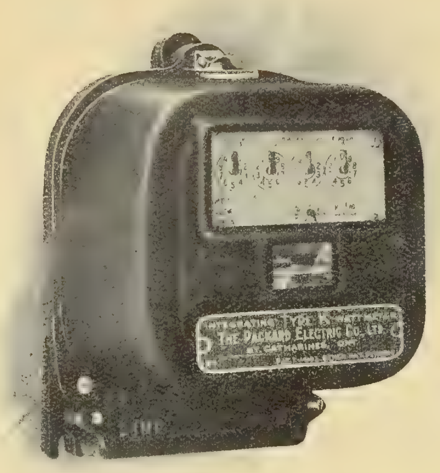
NOTE—Bed Room fixtures can be used as either brackets or pendants

Perfect Design — Perfect Workmanship — Perfect Finish

Write for Your Net Costs also ¼ Size Drawings

The Tungstolier Company
of Canada, Limited

Head Office: 212 King Street West, TORONTO



TYPE K METAL CASE

PACKARD
METERS

For All Circuits

Always Reliable

Permanent Accuracy

Every Meter Guaranteed

TYPE PK POLYPHASE

Large Stocks at St. Catharines and Winnipeg St. John Railway Co., St. John, N.B.
General Supplies, Limited, Calgary, Alta.

The Packard Electric Company, Limited

Factory: ST. CATHARINES

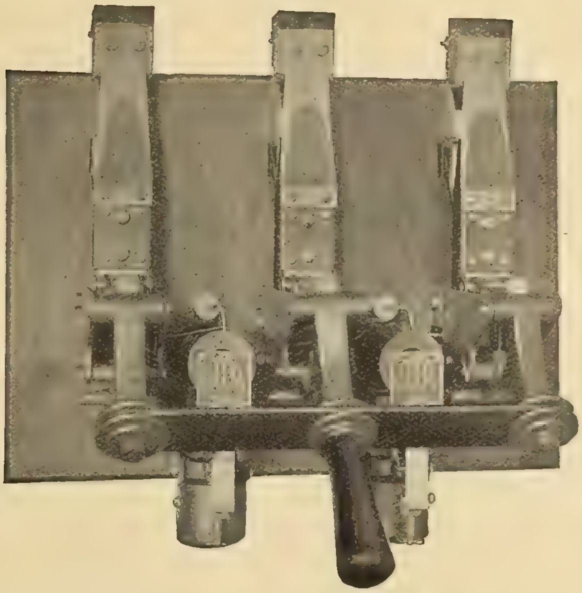
General Sales Office
901-902 Traders Bank Building,
TORONTO

N. W. Office and Warehouse
WINNIPEG

The Induction Motor

is a sturdy piece of apparatus, but staunch though it is there are many exigencies of service from which it should be given such protection as can best be secured by the use of a properly chosen

I-T-E Circuit Beaker



The Type "W," three pole, Time Limit (DALITE) Circuit Breaker shown herewith is admirably adopted to the protection of induction motors operating under a wide variety of conditions. This form, together with others covering practically the entire range of industrial service, is described in our new

HAND BOOK OF THE I-T-E CIRCUIT BREAKER

THE CUTTER COMPANY, Main Office and Factory **PHILADELPHIA**

W. C. Jessup, 120 Liberty Street, New York City.
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H. W. MacVaugh, 1122 Park Building, Pittsburgh, Pa.
Thos. E. Beasley, 751 Ellicott Square, Buffalo, N.Y.
C. E. Wise, 427 Ford Building, Detroit, Mich.
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Eccles & Smith Co., 524 S. Los Angeles St., Los Angeles, Cal.
Eccles & Smith Co., 68 First Street, Portland, Ore.
Electric Manufacturers' Sales Co., Tramway Bldg., Denver, Col.
I-T-E Electric Co., 72 Finsbury Pavement E.C., London, Eng.

Your Lamp Orders

THE excellent service, lasting qualities and high efficiency of Sunbeam Mazda Lamps have immortalized them in the electrical trade of Canada.

If you would sell your customers the best there is, place your orders for

Sunbeam Mazda Lamps

These lamps have a continuous drawn wire tungsten filament that will stand considerable jar and vibration without injury.

They give three times as much light as a carbon lamp with the same current consumption.

Better light for the consumer means more business for the dealer and central station.

Place your orders with us and you will get prompt service. Write to-day for prices and particulars.

The Canadian Sunbeam Lamp Company, Limited

Main Office and Factory:
Dufferin and Liberty Streets
Toronto

Northwestern Office and Warehouse:
173 McDermott Avenue
Winnipeg

No. 0462 Bowl type, sizes 25 to 500 watts

No. 01212, 25 or 40 watts

No. 01211, 40 or 60 watts

No. 01129 shallow type, sizes 25 to 150 watts

VELURIA Commercial Lines PYRO

VELURIA—The most attractive opal glassware for commercial lighting.

PYRO—An inexpensive white glassware with remarkable efficiency.

All shapes are designed to combine a neat, pleasing appearance with the highest possible illuminating value.

In ordering always advise whether Veluria or Pyro is wanted.

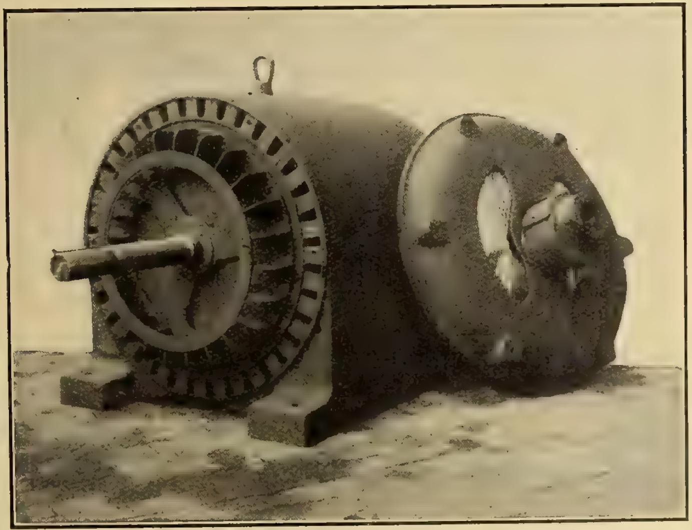
PRICES AND DISCOUNTS UPON REQUEST

The Holophane Company Limited, Toronto, Canada

Holophane Glass Made in Canada

Engineering Works of Canada, Limited

Head Offices: NEW Birks Building, MONTREAL, QUE.



"ENCLOSED MOTOR (showing fan for external circulation)."

Induction Motors

Enclosed Type

The capacity of the ordinary type of enclosed motors is often less than half of the corresponding open type. The patented design of our motors type "NE" embodies a radical improvement of that drawback. The capacity of our enclosed motors is only 15% smaller than the capacity of the same open type, which enables us to supply a motor of a specified rating at a cost only slightly increased over the open type.

Catalogue I mailed upon request

Builders under the patents of the

Societe Alsacienne

ESTABLISHED 1826

Mechanical and Electrical Machinery

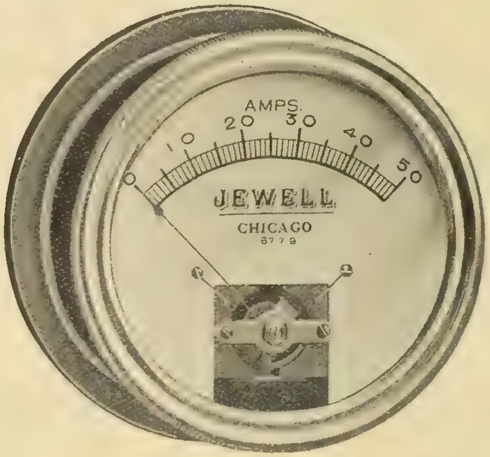
MARSHALL-DAVIS

—LIMITED—

ELECTRICAL APPLIANCES

DUNNVILLE, - ONTARIO

Agents for Jewel Electrical Company, Chicago



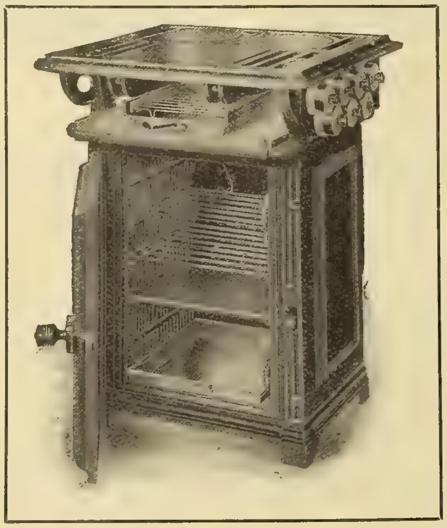
Precision Instruments

for

Switchboard, Laboratory,
Portable, Automobile,
A. C. or D. C.

An Instrument for Every Purpose

PROMPT SHIPMENTS BROAD GUARANTEE



Domestic Cooker No. 660

ECLIPSE

Electric Heating and Cooking Utensils

The proved best appliances upon the British market.

Have been thoroughly tried out in actual use.

Are thoroughly reliable under usual kitchen conditions.

Highly efficient, well made and low in price.

Full information and particulars regarding complete range of apparatus upon application to

The Electric & Ordnance Accessories Company Limited

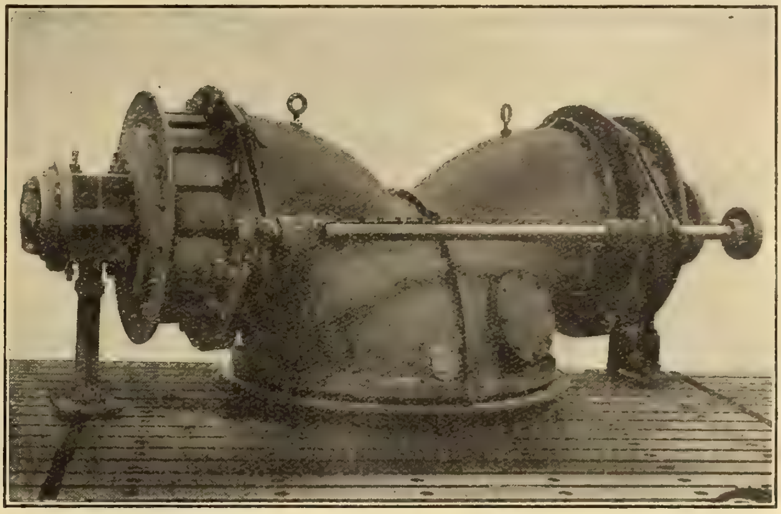
Works:
Birmingham & Hanley, England

Lewis Building, 20-42 Bleury Street - MONTREAL

LOW HEAD TURBINES

DESIGNED AND BUILT FOR

THE HIGHEST EFFICIENCY



TWIN HORIZONTAL TURBINE
650 H. P. 360 R. P. M. 32 Ft. Head

We design and build our Turbines to suit the special conditions of each customer.

We do not ransack the warehouse for something that will do—or nearly do.

As designers and builders of electrical apparatus we know the peculiar requirements of hydro-electric plants.

The customer gets the highest efficiency from the water at his disposal.

Works—Montreal

Sales Offices: MONTREAL, 613 Canadian Express Co. Bldg. TORONTO, 810 Traders Bank Bldg
WINNIPEG 601 Builders Exchange Bldg. VANCOUVER, Dominion Bldg.
COBALT CALGARY

ALLIS-CHALMERS-BULLOCK LIMITED

MURRAY PATENTS

The Metropolitan System

is the only complete system

that

Prevents theft of current

Provides for the complete control of service and meter by the central station

Provides protection to the meter

Reduces the cost of testing

Is adaptable to any size or type of meter

Can be used with any system of wiring

Our devices have been adopted by progressive central stations because it reduces cost of operation and increases revenue.

The Metropolitan Engineering Co.

90 Sherbourne St., Toronto

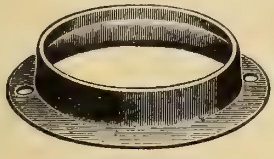
MURRAY PATENTS

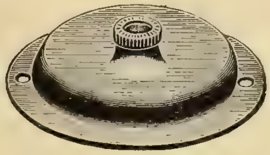
Made in Canada

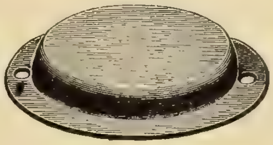
Iron Conduit—Conduit Boxes—Pipe Fittings and Accessories

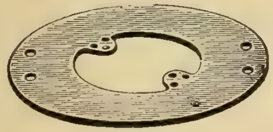
GREENFIELDUCT

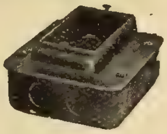
Hot Galvanized Inside and Out

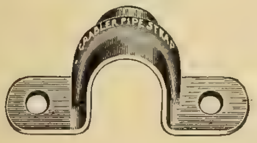


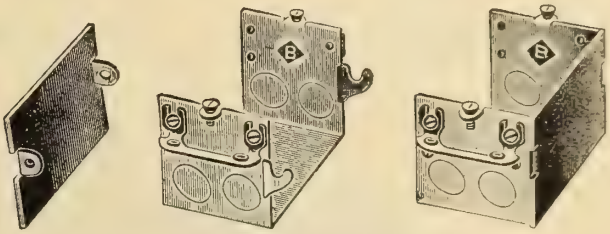












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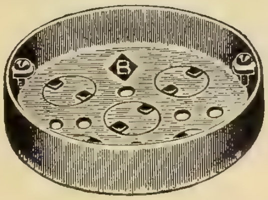
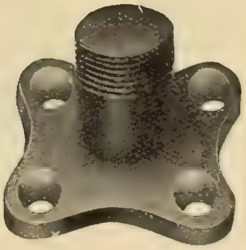
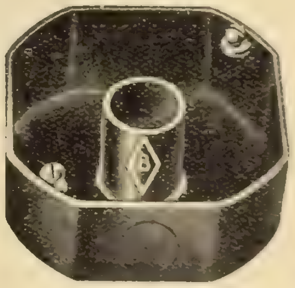
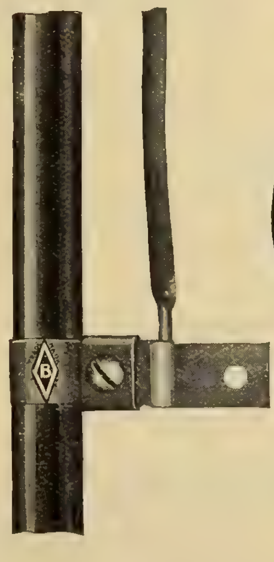
FLEXIBLE CONDUIT FOR ELECTRIC WIRES
TRADE MARK









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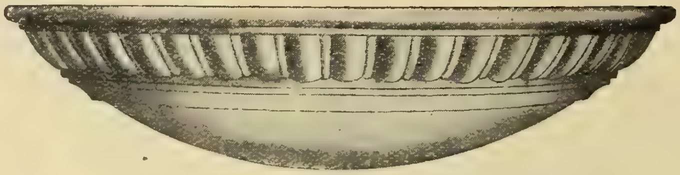
Electrical Fittings Co., Limited

70 King St. West - Toronto - Canada
Munderloh & Co., Ltd., Montreal   John Starr Son & Co., Halifax, N.S.

MOONSTONE GLASS



No. 6020—14″ Moonstone Semi Indirect Bowl

MOONSTONE—The one glass that is adaptable to all illuminating purposes. For Commercial and residence lighting MOONSTONE Shades, Reflectors, Ball Globes and Semi-indirect Bowls are the most efficient of all semi-translucent diffusing glasses.

No. 6024—14″ Moonstone Semi Indirect Bowl
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We can make prompt shipments at all times

The Jefferson Glass Company
Limited

MADE IN CANADA

TORONTO CANADA

MICATENE

H. WEIDMANN, RAPPERSWIL, SWITZERLAND

Specialist in the manufacture of

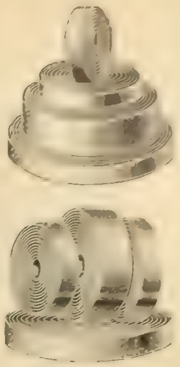
PRESSPAN—(Pressboard)

BEST QUALITY, PROVED BY REPEATED TESTS

Sheets in thickness from 0.1 mm. upwards. Endless Rolls and Strips 0.1 to 1 mm. thickness.

BLACK PRESSPAN IN SHEETS, ROLLS AND STRIPS
Presspan Coils and Tubes for Transformers, Armatures, Discs and Shaped Articles.
VARNISHED PRESSPAN, MICA-COVERD PRESSPAN, &c.

MICATENE (Micanite) in plates, hard and flexible
Micapapers, Mica clothes, Mica insulating pieces.
Tubes for Generators and Transformers in Cartogene (insulating paper with and without Mica)


PRESSPAN

Our Telephones and Apparatus are Par-Excellent

Are Made for Good, Hard, Honest Service

They have withstood the **real test—Years of exacting service.** Our **Telephones represent the last word** in design and construction and are strong, durable and attractive. Furnished in all popular finishes.

Get our prices on Switchboards, Series Telephones, Bridging Telephones, Desk Telephones, Extension Bells, Magneto Bells, Transmitters, Receivers, Induction Coils, Condensers, Magnetos, Batteries, Plugs, Jacks, Drops, Lamps, and all kinds of Telephone, Switchboard and Exchange Equipment, including the most efficient protective apparatus on the market.

LET US KNOW YOUR REQUIREMENTS

Bulletin No. 1—Switchboards and accessories.
Bulletin No. 2—Telephones and accessories.
Bulletin No. 3—Telephone Protective Apparatus.
Bulletin No. 4—Railroad Dispatchers Telephones, Switchboards and apparatus.

LAFAYETTE ELECTRIC & MFG. COMPANY

LAFAYETTE, INDIANA, U. S. A.

"KEYSTONE" RATCHET SOCKET WRENCH

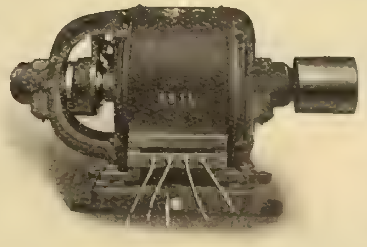
(REVERSIBLE)

24 inch Handle only

The Keystone Mfg. Co.

42 Chandler St. - - Buffalo, N.Y.

"BELL" High Efficiency Single Phase Motors



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Large stock carried throughout the country for immediate shipment.

Attractive Prices consistent with QUALITY

Our bulletin No. 138 which fully describes them will be sent to all interested

Bell Electric Motor Co., 30 Church Street, NEW YORK CITY
LICENSED. Factory, GARWOOD, N. J.
Canadian Representative:
The Masco Company, Ltd., 205 Yonge St., Toronto, Can.
Stock carried in Canada

We Purchase Outright
entire issues of bonds on steam and electric railroad, gas, electric and hydro-electric properties.

N. W. HARRIS & CO.
Established 1882
Incorporated 1911
35 Federal Street, Boston, U.S.A.

A Clear Road To The Money Fields

Continuous direct-to-consumer advertising of Hubbell Reflectors has opened the way to the money fields for hundreds of Dealers and Contractors. Don't be satisfied to sell lamps alone. Follow the trail of every lamp sale and sell

Hubbell Reflectors

Get after the factory trade. Factory owners want reflectors that are shaped right, priced right and above all **quality right.** They get what they want in Hubbell Tin, Brass, Aluminum and Steel Reflectors. This is a live line to tie up to.

Write for Free Advertising and Sales Helps

R. E. T. PRINGLE Mfrs. Agt.
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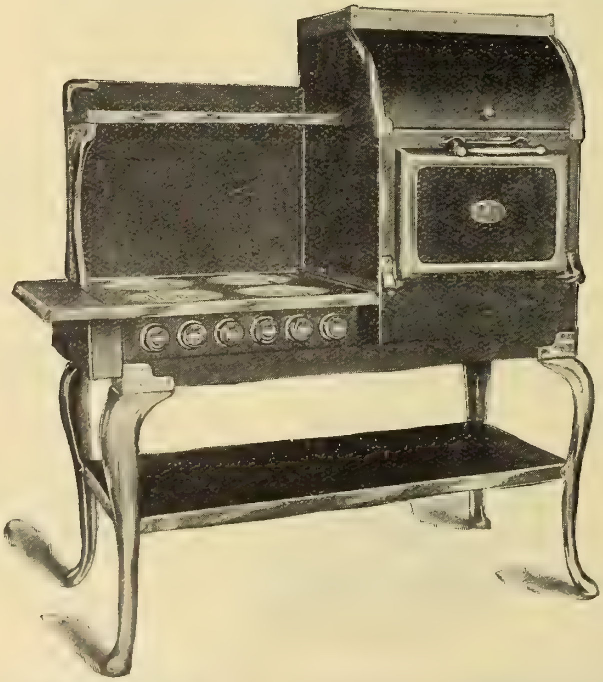
Now Made in Canada



WE are pleased to announce that we have established a factory in Winnipeg for the manufacture of the Hughes Electric Stove, Ranges and Radiators. We feel certain that our Canadian customers will appreciate the establishing of this factory in Canada, assuring prompt shipments etc.

The 1913 models are now ready and contain many valuable improvements, including our new and perfected heating units.

Write for our special Canadian prices, bulletins, etc.

HUGHES ELECTRIC HEATING COMPANY
Winnipeg Office: 902 Home Street
211-233 W. Schiller St., Chicago

Nicholson Arcing Rings

Insulator designers a few years ago sought to obtain the greatest flashover voltage test per unit cost; today we are getting away from that type as rapidly as possible—we want maximum electrical (puncture) strength, preferring less size of insulator if necessary.

Arcing rings **relieve** the insulator during over-stresses. They reduce the **dry**, flashover voltage, but do not reduce the **wet** flashover voltage. The resistance of the surface is **not** reduced, but immediately the arc has formed over the surface it is taken by the rings instead of by the line wire and pin.

Arcing rings are valuable because,—

1. They relieve the insulator of over-stresses, thereby avoiding punctures.
2. They prevent destruction of insulators by the heat of an arc.
3. They prevent the arc burning the line cable.

The Locke Insulator Mfg. Co.

OR

Engineering Equipment & Supply Co.

410 St. James St., Montreal, Que.

The "Stave-Arco" Flaming-Arc-Lamp

The Last Word on Flame Lamps

Guaranteed 100 hours per trim
Economy of Operation
Highest Efficiency
Highest Candle-Power

The Lamp for Outdoors as well as Indoors

—ALSO—

Locke High Tension Insulators
Line—Construction—Materials
Central Station Apparatus
Power and Lighting Supplies
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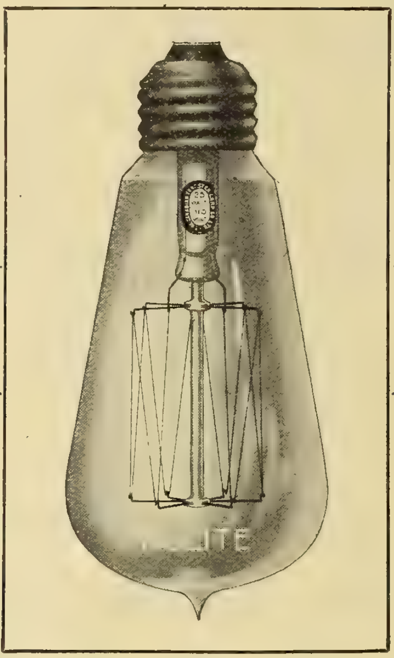
Engineering Equipment & Supply Co.

410 St. James St. - Montreal

Telephones: Main 2242--2243

“NULITE”



Ductile Filament Tungsten Lamp

IMPORTANT

Read this advertisement then consider the factory which stands behind it, and we feel confident that you will be convinced that we are equipped to fill all your needs of “NULITE” drawn wire tungsten and “BRILLIANT” carbon filament lamps.

Have you ever considered that the productive capacity of your workman can be increased 10 to 20% by using Nulite wire drawn tungsten lamps.

Eventually you will replace your old arc lamps with Nulite tungstens and anticipating this, we suggest having you use our 300, 400 or 500 watt “Nulite” which gives a better light and does not demand daily attention through the renewing of carbons.

The enormous growth of our business is attestation of the merit of “NULITE” tungsten lamps.

Place your orders where you will be guaranteed shipment, it will pay you to carry a complete range of our lamps and enjoy the satisfaction of knowing you have the best that skill and money can produce.

WRITE FOR QUOTATIONS

The Canadian Tungsten Lamp Co., Ltd.

Hamilton - Ont.

Branches at—
Montreal—246 Craig St. W.
Winnipeg—56 Albert St.
Vancouver—365 Water St.

Agencies—
St. John, N. B.—T. McAvity & Sons
Halifax, N. S.—Farquhar Bros,, Limited
Quebec, Que.—Mechanics Supply Co., Limited
Toronto, Ont.—Dominion Illuminating Rental Co.

You'll find a ready sale for

Delica White Lighting Glassware

¶ In connection with modern high candle power lamps, Delica White Glassware very closely approaches 100% illuminating efficiency. Its remarkable diffusing qualities break the fierce glare of the Tungsten without sacrificing light value in any way.

¶ You should stock it—NOW—and get the jump on competition. Already it is selling fast. And it's going to sell faster simply because it's the glass that delivers the SERVICE.

¶ We can furnish it in a great variety of shapes — shades for direct and bowls for semi-indirect lighting, and for both domestic and commercial purposes.

WANT TO SEE PHOTOS? JUST DROP A POST CARD.

The Pittsburgh Lamp, Brass & Glass Co., of Canada, Ltd.

113 Wortley Road,
LONDON, ONTARIO

PILABRASGO

Special Representative:
R. E. DAVIS

The Lion M Tungsten Lamps

The Ideal Lamp for Business Premises

Strong, reliable manufacture, Long Life, More Light all the time. Specially adapted for use in Offices, Stores and Factories.

TO THE TRADE

We are now ready to fill large or small orders from stock and make immediate deliveries and complete shipments.

Special prices and discounts on trade orders.

In lots of 1,000 and over, we etch on each lamp any name or mark required free of charge.

Samples submitted for testing.

Special quotations made on request write us your requirements

Electrical Products Company, of Canada

28 Wellington St. West **(Tel. Main 2298)** **Toronto**

District Agents: EDMONTON—Miller & Miller HAMILTON—C. T. Inman & Co., 157 James St. S.

REMOVAL NOTICE

¶ We have the pleasure in announcing that we have removed to our new building

116-118 Richmond Street West,
TORONTO

¶ We take this opportunity of thanking our many friends for the business which has made these larger premises necessary and trust that with larger stock and better facilities we may merit a greater share of your patronage in the future.

CHAPMAN & WALKER, Limited
TORONTO, CANADA

Protection from Lightning Troubles

(MOSCIKI SYSTEM)

The following list of users of the Mosciki System of Lightning Protection speaks for itself;

- Victoria Falls and Transval Power Co.
- Shanghai Municipality.
- Melbourne Electric Supply Co.
- Cleveland and Durham Power Co.
- St. John Del. Key Co., Brazil.
- Societa Dergano.
- Sociedad Espanola, Madrid.
- Societa Electrica Suburbana, Milan. &c.

Lightning, if unchecked, will break the windings of your apparatus, blow out your fuses and break down your transformers.

In short, lack of adequate and capable lightning protection may mean to you serious loss of time, money, and perhaps lives.

A host of so-called lightning arresters are on the market, but 99 per cent. of them are valueless because the principle on which they are constructed is wrong.

High frequency—not high voltage—is the cause of the damage done by lightning.

Most protective systems work on the principle that high voltage is the cause of the damage. This is incorrect, hence their uselessness.

A lightning protection apparatus to be of any use **must offer a clear path to earth for high frequency currents independent of voltage.**

The MOSCIKI System of Lightning Protection fulfills this condition absolutely—it's principle is correct—its design the best and its guarantee absolute. Write us for fuller particulars.

Mosciki Lightning Arrester

Exclusive Canadian Agents

CHAPMAN & WALKER, ELECTRICAL ENGINEERS AND CONTRACTORS
116-118 Richmond Street W., TORONTO

Evershed & Vignoles, Limited

Manufacturers of

Eversheds Meggers, Bridge-Meggers and Ducters,

Portable and Switchboard Types Voltmeters, Ammeters, Watt-Meters, Power Factor and Frequency Meters.

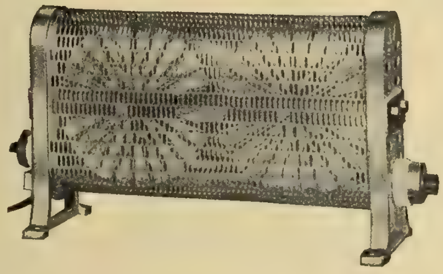
Indicating and Graphic: Pen and Inkless

Sole Canadian Agent

R. H. NICHOLS, Dineen Building, TORONTO

Agents at MONTREAL OTTAWA WINNIPEG VICTORIA

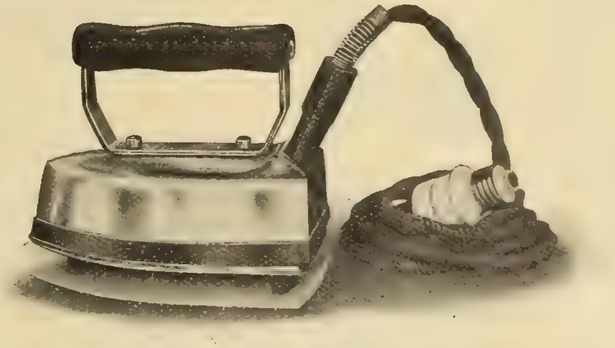
Do you sell "Economic" Line?



Royce Patent "Economic" Electric Radiators

Made by

ROYCE & CO.



Royce Patent "Economic" Electric Iron

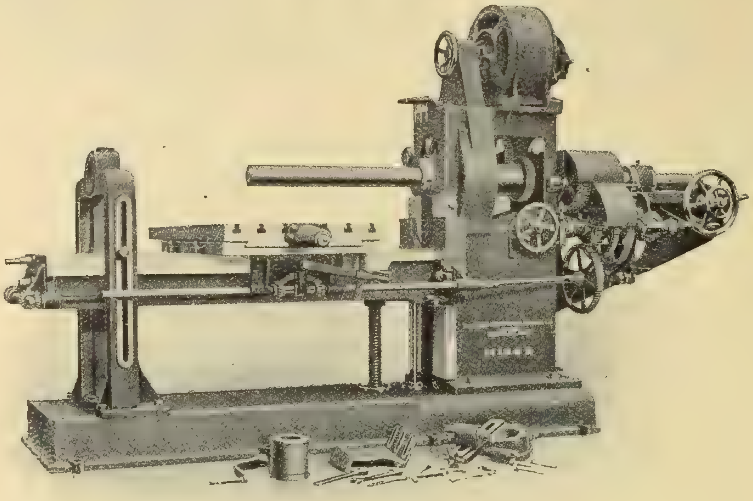
THE "Economic" line of electric heating devices is a most profitable line to handle. They bring a good profit to the dealer or central station and are practically indestructible. The "Economic" heating element will carry a 100% overload without burning out—if operated on rated voltage it should **never** burn out.

In addition to the iron and radiator illustrated here, the "Economic" line includes Disc Stoves, Water Urn Heaters, Tailors' Irons, Car Heaters, etc. *Send for prices and particulars.*

The Ferranti Electrical Co. of Canada, Ltd.

TORONTO WINNIPEG

Bertram Boring and Drilling Machines



No. 4 Horizontal Boring and Drilling Machine Equipped with Power Crossfeed to Table

WE MANUFACTURE

- Horizontal Boring and Drilling Machines
- Car Wheel Boring Machines
- Vertical Boring and Turning Mills
- Multiple Drilling Machines
- Vertical Drilling Machines
- Radial Drilling Machines, etc.

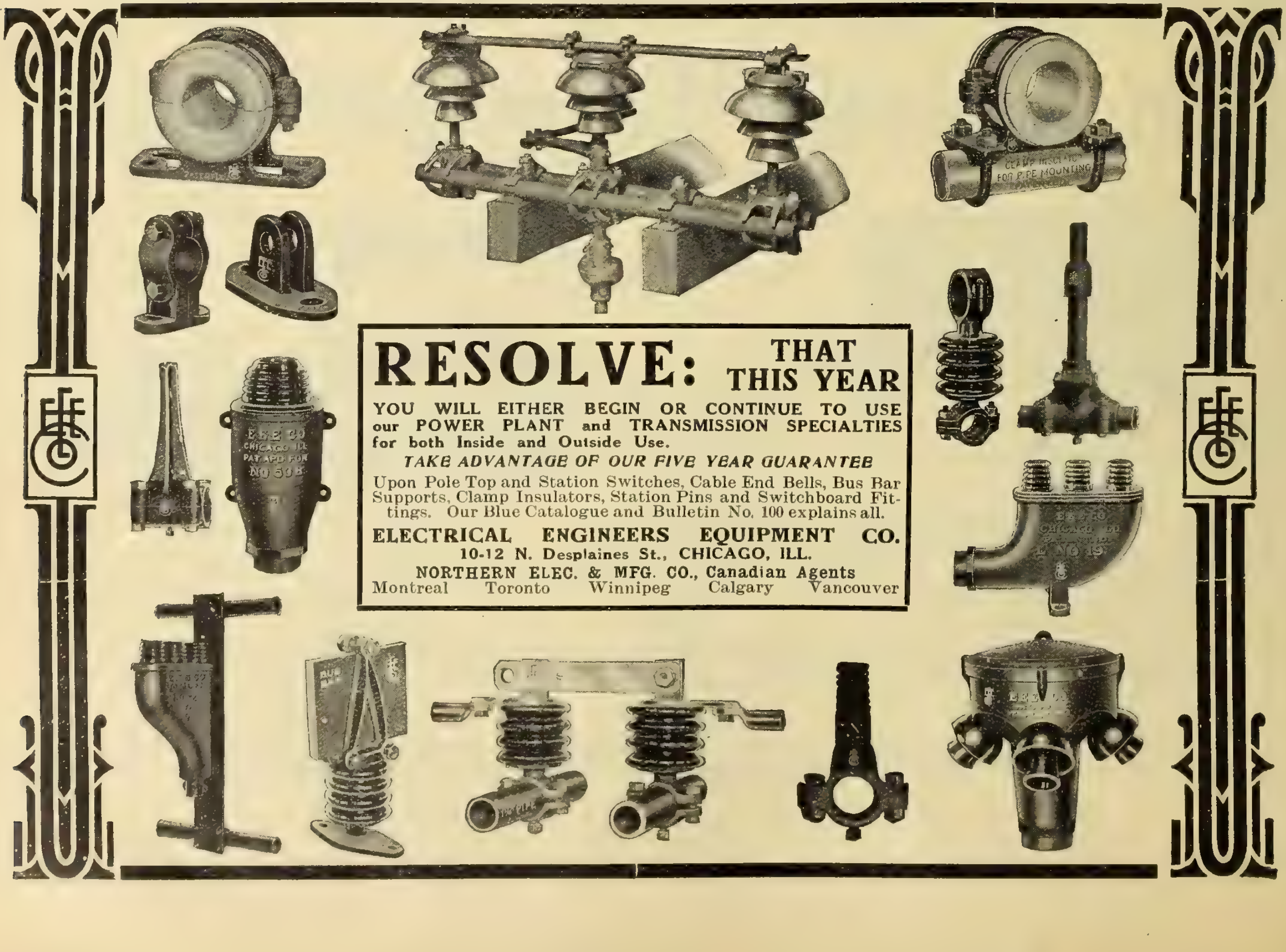
FOR ALL CLASSES OF WORK

WRITE FOR PARTICULARS

The JOHN BERTRAM & SONS CO., Limited

DUNDAS, Ontario, Canada

Sales Agents: The Canadian Fairbanks-Morse Company, Limited


CLAMP INSULATOR FOR PIPE MOUNTING
E.E.E. CO CHICAGO ILL PAT APD FOR NO 50B

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YOU WILL EITHER BEGIN OR CONTINUE TO USE our POWER PLANT and TRANSMISSION SPECIALTIES for both Inside and Outside Use.

TAKE ADVANTAGE OF OUR FIVE YEAR GUARANTEE

Upon Pole Top and Station Switches, Cable End Bells, Bus Bar Supports, Clamp Insulators, Station Pins and Switchboard Fittings. Our Blue Catalogue and Bulletin No. 100 explains all.

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10-12 N. Desplaines St., CHICAGO, ILL.
NORTHERN ELEC. & MFG. CO., Canadian Agents
Montreal Toronto Winnipeg Calgary Vancouver

Electrical News
Generation, Transmission and Application of Electricity

PUBLISHED SEMI-MONTHLY BY
HUGH C. MacLEAN, LIMITED,
HUGH C. MacLEAN, Winnipeg, President
THOMAS S. YOUNG, General Manager.

HEAD OFFICE - - 220 King Street West, TORONTO
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Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the advertiser.

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The "ELECTRICAL NEWS" will be mailed to subscribers in Canada and Great Britain, post free, for $2.00 per annum. United States and foreign, $2.50. Remit by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Vol. 22 Toronto, March 15, 1913 No. 6

An Eighty Per Cent. Load Factor

Load-factor may be defined as the ratio of the total number of kilowatt hours sold, to the total number of kilowatt hours a plant is capable of delivering over a stated period, generally 24 hours. It varies from a minimum of 15 per cent. or 20 per cent. to a maximum of 80 per cent. or higher. It is probably safe to say that in the vast majority of central stations it runs below 50 per cent., perhaps below 40 per cent. This means at least that the revenue from most electric plants is only 40 per cent. what it, theoretically, should be—a point not appreciated by the consumer and often, it is said, not recognized by the central station operator himself. The matter, however, is one of the biggest questions confronting the central station man to-day and with increasing competition and lower rate tendencies threatens to reduce revenue to the vanishing point.

That much can be done in improving the load factor has been demonstrated during the last three or four years by many of our well-managed systems and the fact that in central Ontario there is one group of plants actually operating up to an average of 80 per cent. capacity during the 24 hour day shows what a diversified load can do in the way of solution of this problem. In this particular plant they have, of course, a load which is unusually near the ideal—a pulp mill and cement mills which operate continuously—but there are to-day so many small electric articles which are at the same time practical, luxurious and commercially satisfactory that no central station seems justified in dragging along on a 15 or 20 per cent. load factor.

In this connection possibly the most promising load of the future, for the average central station, is storage batteries. These possess the advantage that they can be charged at any time to suit the plant. There is no doubt that batteries are not yet as generally used as their usefulness, life and efficiency would justify. Where the peak load is of short duration they may be used to advantage in the main power house or they may carry a light load at any hour when the load does not justify the operation of the plant. Two of the smaller sized plants in western Canada are reported to be getting splendid results from batteries used in this way.

It is worthy of note also that improvement in load-factor not only increases the revenue, but makes it possible to reduce the general rate to the consumer—a course always justified, not only in that a still larger load is induced, but also in that the attitude of the consumer becomes more friendly with every indication that his interests are being considered.

Value According to Comparative Worth

What appears to be a precedent was recently established by the judgment of Chief Justice Davidson regarding expropriation proceedings taken by the Cedars Rapids Manufacturing & Power Company, regarding two islands belonging to the De Beaujeu estate, Montreal. The Cedars company required two islands, the Isle aux Vaches and the Pointe du Moulin. The matter was originally arbitrated according to a statute of the province of Quebec which gives the owner of a water power right to expropriate property in the neighborhood required for the development of his power. The arbitrators' award for the two islands totalled $4,500—their value when considered only as farm lands. This award was opposed by the De Beaujeu estate on the ground that the value should have been fixed from an industrial point of view. This contention has been upheld by the recent decision which places the value of the two islands at $142,000. By this judgment it would appear that a precedent has been established whereby expropriation values will be regulated by the comparative worth of the property expropriated with reference to its value as a part of the completed plans of development.

Hydro Developments

The citizens of the town of Collingwood will long remember the night of the 24th of February, 1913, when the introduction of hydro power marked a new era in the prosperity of this town. Hon. Adam Beck was present and the town hall, where a banquet was given in his honor, was overcrowded to accommodate the guests, which included Hon James S. Duff and Major Currie, M.P.

The power is obtained from the Big Chute on the Severn River, where the falls have been developed by the Simcoe Railway & Power Company, who sell under contract to the Hydro-electric Power Commission of Ontario. At this point there is a thoroughly modern generating plant of about 7,000 h.p. capacity. The turbines were built by the Wm. Hamilton Company, of Peterborough, and the generators by the Canadian Westinghouse Company. The plant was designed and the equipment installed under the supervision of C. H. & P. H. Mitchell, consulting engineers, Toronto.

Collingwood is one of the group being served by high tension transmission lines now being installed by the Commission to cover the section including Orillia, Barrie, Penetang, Midland, Collingwood and smaller towns included in this area. Power is transmitted along this line at 25,000 volts. At Collingwood it is stepped down to 2200 volts, at which pressure it is distributed throughout the town for light and power.

The agreement between the Hydro-electric Power Commission and the Simcoe Railway & Power Company is as follows:—200 h.p. $21 per h.p. year at 2200 volts, or $20 per h.p. year at 22,000 volt. 500 h.p. $20 and $19. 1,000 h.p.

$19 and $18. 1,500 h.p. $17.50 and $16.50. The town of Collingwood contracted for 700 h.p. at $33.97 per h.p. year. This amount is already over-sold and it is anticipated that next year twice the amount will be required. The system is under the control of a commission of three; Messrs. J. A. Caslake, chairman, Mayor R. Gilpin and H. A. Currie. Mr. E. J. Stapleton, who has been in charge of the construction work throughout, is now superintendent of the system.

As illustrating the advantages already accruing from the installation of this system we quote the following from the Collingwood Enterprise:

"The Enterprise Publishing Company is one of the first plants in town to utilize the new power. All our presses are now harnessed up to hydro-electric, and it is astonishing what a difference it makes. The smooth running of the presses is particularly noticeable, whether run by day or night, and regardless of the number of machines running at once. The running of the Monoline machine alone would warrant the introduction of the new power."

Electricity on the Farm

In order to satisfy the growing demand for electric light and power in rural districts the Electric Power Company are now actively engaged in building a number of rural distribution lines. One of these, viz., a 2200 volt, single phase line, about 10 miles in length, from Napanee through Newburg to Camden East, has now been in operation for some time. It is fed from the Electric Power Company's sub-station at Napanee. Distributed over the 10 miles of line are now about sixty customers.

Another of these lines, extending about 12 miles in a southeasterly direction from Campbellford, will be in operation before the end of the present month, with between 20 and 25 customers, most of whom have contracted for from 1 to 3 h.p. There is also one customer on this line who has contracted for 25 h.p. The line will be fed from the Stephens Dam power house at Campbellford at 6600 volts, single phase. Pole type transformers are used, having a ratio of from 6600 to 120/240 volts. As a rule a separate transformer is installed for each customer.

Other lines in prospect, which will be constructed in the near future, are as follows:

From Lindsay to Mariposa and Oakwood.	12 miles
From Whitby to Pickering	12 miles
From Belleville to Foxboro	5 miles

The farmers along the routes of these lines are having their houses and barns wired for lighting and are installing motors for pumping water, sawing wood, chopping feed and various other purposes.

Copper in 1912

A preliminary report on the mineral production of Canada during the calendar year 1912 has just been published by the Department of Mines, in which some interesting information is given with reference to the production and price of copper during the year. The average price is given at 16.341 cents, as compared with 12.376 cents in 1911, 12.738 cents in 1910, 12.982 cents in 1909, 13.208 cents in 1908 and 20.004 cents in 1907. It would appear that during the past year copper has made its first recovery from the 1907 slump caused to a very considerable extent by the advent of aluminium into the field of electrical conductors. With reference to copper the report contains the following:

"There is practically no recovery of refined copper in Canada and the production is represented by the copper contents of smelter products, matte, blister-copper, etc., together with the amount of copper contained in ores exported, estimated as recoverable. The total production on this basis in 1912 was 77,775,600 pounds, valued at $12,709,311 as compared with 55,648,011 pounds valued at $6,886,998 in 1911, an increase in quantity of 22,127,589 pounds and in value of $5,822,313. Quebec province is credited with a production of 3,225,523 pounds as against 2,436,190 pounds in 1911, the increase being due to the increased production from the pyritic ores of the Eastern Townships. Ontario's production in 1912 was 22,250,601 pounds, as compared with 17,932,263 pounds in 1911, being mainly derived from the nickel-copper ores of the Sudbury district. Apart from the copper shipments from Dane, the most interesting occurrence was the payment made for copper in shipments from the Cobalt camp. British Columbia had a record output of 50,526,816 pounds, having had a year of uninterrupted smelter operation free from strikes and other disturbances. From the Yukon the Pueblo mine was a heavy shipper. The New York price of electrolytic copper varied during the year between 13.75 cents per pounds in February, to 17.60 in August, the average for the year being 16.341 cents as against an average monthly price of 12.376 cents in 1911. The exports of copper in 1912 were: copper, fine in ore, etc., 76,542,643 pounds, valued at $8,800,276 and copper black or coarse and in pigs, 1,945,921 pounds, valued at $236,212. The total imports of copper in 1912 were valued at $7,052,534."

Mr. Wickes' Statement Explained

In our issue of February 1, reference was made to a report by Mr. Wickes on the Underwriters' Laboratories of Chicago, and special mention was made of a remark in the report concerning the allegation that it was necessary to gain the inspectors' good will by means of a tip in order to facilitate the passing of material submitted. Our editorial remarks were written under the impression that these inspectors were a part of the Underwriters' Laboratories organization, and we had this connection in mind when we suggested that steps should be taken to show up the workings of the Underwriters' Laboratories.

The following extract from a letter from Mr. W. H. Merrill, manager of the Underwriters' Laboratories, makes it plain, however, that our inference was in error, and we are very pleased to be able to revise our interpretation of the report, as will, doubtless, many of our readers. Mr. Merrill points out that there is no connection whatever between the inspectors (referred to in the report) and the Underwriters' Laboratories, and writes in part,—"Mr. Wickes says in effect that representations are made that certain inspectors in the field (who may be operating under government or city or underwriters or other authority) object to passing electrical fittings not bearing our approval, and in certain cases it is intimated that these inspectors might be open to bribery or their opinions influenced by tips or "douceur." Please note that these inspectors to whom Mr. Wickes refers are not and cannot be connected in any way with this institution, as we have no one in our employ engaged in inspection work in building equipments, our efforts being exclusively confined to experimental work in our testing stations and examinations of approved wares at manufacturers' plants where such wares are turned out. Through many years of earnest and constant effort we have built up a good-will for this institution which is based more than on any other one thing on the integrity of all members of our staff."

> If you work for a man, in Heaven's name **work for him.** If he pays you wages that supply your bread and butter, work for him; speak well of him; stand by him and stand by the institution he represents. If put to a pinch, an ounce of loyalty is worth a pound of cleverness.

Montreal Underground

The Quebec Public Utilities Commission have passed the plans of the Montreal Electrical Commission for underground conduits on St. Catherine street, from Guy street to Papineau avenue. This is the first section of the work, which will ultimately cover the city. Tenders for the construction of the conduits will be called in the near future. The system consists of groups on main runs of 3½ in. square tile, standard lengths, for all main ducts, 15 on the north side from Guy street to Papineau avenue, and 20 on the south side in one section and 16 in other parts. Provision is made for the cables of the tramways company, lighting, and power companies, etc., which, together with other parts of the conduits, will be rented to the companies at a sum which will pay for maintenance, cost, etc., the whole cost to be paid off in forty years.

The service ducts are 3½ in. round fibre; these run from the service manholes to the various stores or houses in each block, with a maximum of eight services from each service manhole. There are also on each side of the street groups of 3½ in. fibre conduits for the various signals, such as fire alarms and street lighting circuits. Access to the main ducts is given through manholes on each side of the street at the various street intersections, there being four of these manholes at the street intersections where the tramways cross or join, and at all other street intersections there are only two main manholes, where are also situated transformer manholes, where the current is transformed. The main and signal conduits cross St. Catherine street at the street intersections between the main manholes. The plans have been drawn under the direction of the Montreal Electrical Commission, with Mr. A. S. Clarson as acting chief engineer.

Public Service Corporation

The Saraguay Electric and Water Company have changed their name, in accordance with the recent act of the Legislature, to Montreal Public Service Corporation. The company have acquired the Paul Electric Light & Power Company, the Dominion Light & Power Company, and the distribution lines of the Canadian Light & Power Company, so that in future the distribution on the Island of Montreal of light and power by the Robert interests will be carried out under the name of the Montreal Public Service Corporation. Mr. E. A. Robert is the president of the company; Mr. H. R. Mallison, secretary-treasurer; and Mr. K. B. Thornton, chief engineer and operating manager. The interests of the Montreal Tramways Company, the Montreal Public Service Corporation, and the Canadian Light and Power Company are in the hands of the holding company known as the Montreal Tramways and Power Company. The current for the Montreal Public Service Corporation is supplied by the Canadian Light and Power Company.

Calgary Report

Superintendent of Light & Power R. A. Brown has prepared a report covering the operations of his department during 1912, which shows a surplus of over $36,000 for the year. As indicating the advantages of municipal ownership in Calgary, it is pointed out that in 1905, when the city decided to install its own plant, power was selling at 18c per kw.h., which has been gradually reduced to 7½c, the present rate. The new street lighting now covers 201 miles of streets, with 1100 lights, of which 600 are magnetite arcs, 260 a.c. enclosed arcs and 240 50-watt, 6.6 amp. tungstens. Mr. Brown states that though a by-law has been passed providing for the installation of five-light ornamental standards on a number of streets in Edmonton, the magnetite arcs which have been given a good test since the vote was taken on the by-law, have proven so satisfactory that it appears to be the concensus of opinion that the arc light is preferable to the tungsten standards. The estimates for the current year provide for an expenditure of $460,000.

Undergound Conduit Statistics

Steps are being taken by the National Electric Light Association to compile a record of the towns and cities in the United States and Canada which have underground circuits and systems together with the nature and extent of the same. This information is to be regarded as confidential and will be kept on file for reference in cases where such work is proposed. The collection of this information has very generously been undertaken by Mr. G. M. Gest, the well-known conduit specialist. To this end cards are being sent to the general managers of all central station plants in Canada and the United States, asking whether they have any conduit installed, whether the telephone, telegraph, traction companies or the municipality have ever done such work, and, if so, what is the amount in each case. There is no doubt that a compilation of this form of information would be exceedingly valuable and all central station managers are urged to answer the questions promptly and fully.

Electricity for Farm and Home

At Greenwood, Ont., there is a small private hydro-electric plant which is demonstrating the value of electric power on the farm and in the country home. The plant is owned by Mr. F. L. Green, miller and farmer, and its construction and operation are briefly described by the owner as follows:

"We already operated a flour mill by water power, and so did not need to build a dam specially for the electric power. We, however, use a separate 10 h.p. water wheel to drive a 5 h.p. dynamo. The water wheel is fed from the main penstock which feeds the large mill wheel. It is a horizontal Leffel type with vulcan gate enclosed in an iron case and operates under a head of about 42 feet running at 800 revolutions per minute. The dynamo, which is a direct current 110 volt machine, is belted to the turbine. No governor is used on the water wheel and any change of load is regulated by taking off or putting on more water on the wheel. As the mill is running practically all the time, and lights from this dynamo are used there, the mill hands can notice the change in voltage representing a change in speed and they regulate the wheel accordingly. If the wheel was isolated as it would be if it were a separate installation used for no other purpose than lighting, it would, of course, be necessary to have a water wheel governor to regulate the speed or some other method of voltage regulation.

We use the dynamo for lighting the mill, office, barns, stables, dairy building and residence, which is done in a most satisfactory manner, the buildings being all well lighted and my house exceptionally so. We have over forty 16 candle power lamps in the house and some 25 candle power tungstens. We generally have about half of these on and run the dynamo a little fast to give 4 to 5 volts above the marked voltage of the lamps so as to get a better and brighter light. From the steady and even speed of the water wheel we get a very steady light. I have noticed that dynamos when driven by a gasoline engine sometimes give an unsteady light which is hard on the eyes, as the light goes up and down following the necessary changes of speed in the engine.

Besides lighting my buildings I have a motor in my dairy building to drive my separator, pasteurizer, churn and milking machine, and over my dairy building we have a well-equipped work shop so that we do most of the repair work required on the farm as well as manufacture a lot of material. In this shop we have a small circular saw and an emery wheel both motor driven.

I might also say that we are connecting our vacuum by underground piping to the house, which we have had piped for a vacuum cleaner. In this way our vacuum pump, which we now used in connection with our milking machine, will also give us the necessary vacuum in the house.

We have had this electrical installation in operation for several years, and it has given very little trouble and very little expense. My present intention is to put in a dynamo large enough to run a motor to drive a threshing machine, fill the silo, and do other heavy work around the farm. Of course, the installation of this plant cost very much less than it would if I had had to build a dam and put in a water wheel just for the electricity. However, where a small water power is available in a convenient point there is no reason why a few farmers could not club together and put in a plant to supply them with light and power at a cost which would be very moderate compared to the advantages they would derive from it. There is no question in my mind but that electricity cannot be equalled for availability and ease of control and operation where a water power is available.

I might add to the above that I have a laundry room built next to my dairy and am arranging to run the washing machine, wringer, etc., by electricity. Electricity is already used for ironing, also for heating water and making tea and coffee for the table."

Air Purified by Ozonators

By Mr. S. W. Canniff

The atmosphere is a mixture of gases made up chiefly of oxygen and nitrogen which form 97.7 per cent by weight. Nitrogen, atomic weight 14, constitutes 77 per cent. by weight of the atmosphere. It is an inert gas, whose function, with respect to human life, is to modify the action of other gases. Oxygen, atomic weight 16, is the most important constituent of the air. By weight it is about 20 per cent. of the atmosphere, and by far the most abundant element in nature, probably forming in a state of combination about one-half the whole weight of the globe. Burning, generally speaking, is oxidization; i.e., a combining of oxygen with other substances to form compounds essentially different from their constituents.

Oxygen combines more or less readily with every element except flourine and five very rare gases; krypton, neon, argon, xenon, and helium which have never been known to combine with any elements. Chiefly by this widely applicable means, namely, the ready combination of oxygen, nature destroys obnoxious and dangerous matter. A convincing illustration of this is found in the fact that the warmth of the body is produced by a continuous burning up of objectionable tissue by the oxygen of the air drawn into the lungs. In the economy of nature, this is at once a process of purification and production, whereby food matter in being consumed evolves heat energy.

Ozone is a form of oxygen in its most active state. In chemical terms it is represented by the formula O_3, as compared with normal oxygen, which is O_2. This means that the normal oxygen unit or molecule O_2, is made up of two atoms which are in fairly stable relation, while the ozone molecule O_3 is made up of three atoms of oxygen. This, however, is a combination which is very unstable and hence extremely active. The extra atom is, so to speak, held by very slight restraint, and is eager to break loose from its kind and to combine where there is greater chemical attraction.

Ozone is produced in a variety of ways in nature, the most spectacular being by the electric discharges from cloud to cloud to earth in thunderstorms. It is supposed, then, that the molecules of O_2 become ionized; i.e., disrupted, and the liberated atoms collide at great velocity to form new combinations or molecules of O_3, ozone, which is highly active as compared with ordinary oxygen, O_2. Ozone is comparatively absent from cities and malarial regions, but fairly abundant in mountains and especially evident in coniferous forests. Therefore the amount of ozone appears to vary directly as the degree of atmospheric purity in the locality. Vice versa the amount of ozone present should regulate the purity of the atmosphere. This is because ozone is an intense oxidizer; it attacks and destroys many organic bodies not actively attacked by normal oxygen, and, in general, all noxious gases and substances are organic.

From the above it is patent that the presence of ozone is an index of healthful surroundings, or the converse, the absence of ozone is a proof that all of nature's purifier having been utilized the air is contaminated and will become increasingly so until a fresh supply of ozone is available.

Ozone is now being produced in considerable quantities by an electric device called the Ozonator. The production of ozone artificially and, at least, commercially is based on precisely the same principles as exist in its generation by the lightning discharge. A miniature artificial lightning discharge of great area is provided by means of electrified plates surrounding a field under electric stress, through which air is passed. It has become generally known, therefore, that ozone can be quickly and conveniently produced by the discharge of air between electrified surfaces, and apparatus built on these principles is in very common use.

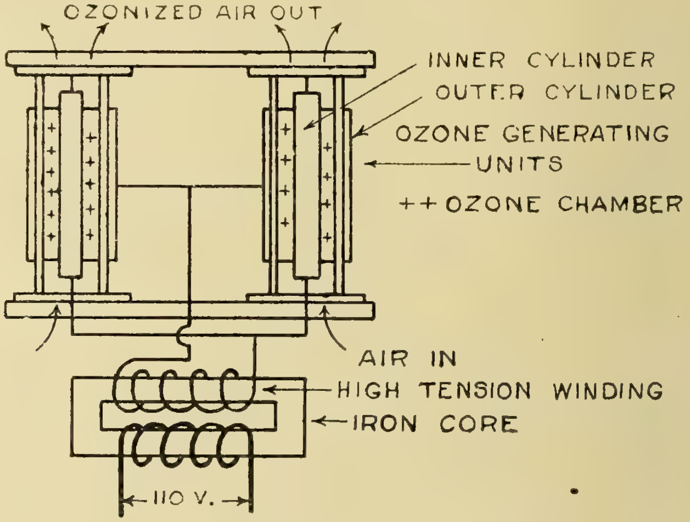

Fig. 1.—Wiring plan of Ozonator

The Ozonators contain a step-up transformer, and ozonizer, and controlling switches. The accompanying figures will illustrate the principles involved. The step-up transformer is situated in the lower part of the case and changes the supply voltage in the alternating current machine to a value sufficiently high to produce ozone when applied to the ozone-generating units. The correct voltage has been very definitely determined by experiment, and established at a value that will not give harmful gases within a limit that can be detected by the recognized methods of measurement. Above the transformer is the ozonizer proper, consisting of a bank of ozone generating units. Each unit consists of a cylindrical glass tube, on the outside of which is a metallic coating, and inside of which is a metal electrode. The latter is built up of shallow perforated metal cups mounted on a spindle concentric with the tube. The cups are of such a diameter as to allow a small but definite air-gap to pass between them and the surrounding glass tube. When one high-voltage lead from the transformer is connected to the outer coatings of the glass tubes and the other to the inner electrodes a violet electrical discharge takes place through the air enclosed in this space. This discharge through the air in the small air-gap changes some of the oxygen of the air into ozone.

Ozonators are made in a number of sizes. The smaller size, shown herewith, has two generating tubes with an output of 150 milligrams of ozone per hour, and a power consumption of approximately 11.5 watts. This device is strongly built, and has a painted metal cover, and is suitable for the purpose of sanitation in such places as lavatories, basements, small kitchens, etc. Connection currents set up by the heat of the transformer maintain a continuous movement of the air, which enters from beneath in the impure state and passes out at the top charged with ozone.

The medium size has four generating tubes, with an output of 400 milligrams of ozone per hour, and a power consumption of approximately 15 watts. This is a beautifully constructed device, and will harmonize with the finest furniture in any residence or hotel. The case is of solid mahogany, provided with handles consistent with the finish of the case, and is used for purifying the air in homes, theatres, hotels, offices, etc.

A large size ozonator, in addition to the step-up transformer, ozonizer, and controlling switches, is provided with a motor driven fan. This fan insures a flow of air through the generating tubes (nine in number) and a thorough expulsion of the ozonized air into the room, thereby increasing the effectiveness of the device. The output of this machine is 678 milligrams of ozone per hour. It will deliver 113 cubic meters (4,000 cubic feet) of ozonized air per hour, which, under ordinary conditions, is sufficient for a room of 50,000 cubic feet capacity, such as large offices, banks, theatres, churches, public halls, etc. The power consumption of this ozonator is approximately 78 watts.

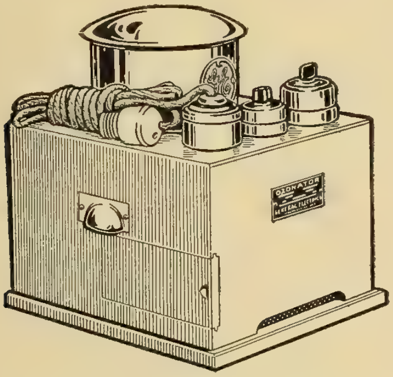

Fig. 2.—Showing small type Ozonator

A fourth, or extra large ozonator, is similar in construction to the one previously described (large size) but has 25 generating tubes with an output of 1400 milligrams of ozone per hour. This type is for use in extensive buildings, large theatres, factories, etc., where large quantities of ozone are required. The power consumption of this ozonator is approximately 105 watts.

Ozone is becoming a very important adjunct to all ventilating systems, as it is used extensively in conjunction with blower heating and ventilating systems, the ozone generating tubes being placed in the air intake of the fan, thus purifying the air before it is heated and distributed. This applies to such places as stations, public buildings, departmental stores, etc. The most extensive system designed for the specific purpose of purifying the air by the use of ozone is the subways of London, where 8,000,000 cubic feet of air per day are ozonized. Previous to this installation the subways were subject to much adverse criticism, but they are now favorably commented on.

Operating Costs of Gas Plant

Many of the smaller towns in Canada are installing gas engine plants of a capacity of approximately 100 h.p. or under, and are apparently producing power at a rate which compares favorably with the figures shown in many large central stations. Actual operating figures are, of course, always very difficult to obtain, and the following data from the records of a municipal electric lighting plant at Minster, Ohio., given by Mr. Utz, in a recent issue of "Power," should be typical of what might be expected from these plants under average conditions.

The plant consists of one 12 x 12-in. and one 11 x 12-in., three-cylinder vertical four-stroke-cycle gas engines direct connected respectively to 62.5 and 50-kw., 250-volt direct-current generators.

Table 1. Typical Daily Load

Time	Cu. ft. of gas consumed per hr.	Output in kw. hrs.
1 a.m.	415	26
2	410	24
3	390	24
4	385	23
5	375	23
6	325	13
7	400	25
8	550	40
9	475	36
10	475	35
11	475	35
12 noon	400	26
1 p.m.	375	25
2	375	45
3	475	36
4	500	40
5	475	38
6	425	26
7	475	31
8	585	43
9	590	43
10	450	27
11	400	23
12	325	19
Total	10,725	723

Average gas consumed per kilowatt-hour=14.8 cu. ft.
Oil consumed = 4 gal.

Both engines have make-and-break ignition, current for engine No. 1 being supplied by a magneto bolted to the engine frame and driven by a friction pulley from the flywheel; engine No. 2 is supplied by a ¼-kw. generator belted to the engine shaft. Both are equipped with batteries for starting or for use in case of breakdown of the magneto or generator.

Compressed air at 225 lb. pressure is used for starting, this being furnished by a 3 x 4-in. duplex compressor, belt-driven by a 2-h.p. gas engine. Natural gas of about 900 B.t.u. per cu. ft. is used for fuel. The engines are lubricated by the splash system and use four gallons of oil per 24 hours, the oil costing 19c per gallon.

The first cost of the engines, generators, air compressor, tanks, switchboard, etc., was $9,000. Engine No. 1 has been in service three years, running about 16 hours per day, and engine No. 2 has been in service two years, running about 18 hours per day. The repairs on these engines since their installation have been practically nothing, and the service is good.

Owing to the fluctuations of the day load, and the ease of starting an engine, one engine is started and stopped quite frequently. An engine can be started, brought up to speed and cut in at the switchboard in parallel with the other in a little over a minute.

Table No. 1 shows how the load varies during different periods for a typical daily run, and Table 2 gives the gas consumption and electrical output for the month of April, 1912. Table 3 gives figures on the cost of power for one month, is fairly accurate and also a good average for the year.

Table 2. Gas Consumption and Electrical Output for One Month

Date	Cu ft. of gas consumed	Output in kw.hrs.	Fuel cost per kw.h. in cts.
April:			
1	9,500	560	0.0050
2	9,850	599	0.0049
3	10,200	635	0.0048
4	9,825	587	0.0050
5	9,725	566	0.0051
6	10,950	684	0.0048
7	6,350	369	0.0051
8	10,000	642	0.0046
9	9,850	625	0.0047
10	10,050	638	0.0047
11	9,875	653	0.0045
12	10,000	660	0.0045
13	10,650	682	0.0046
14	5,875	304	0.0058
15	10,125	665	0.0045
16	9,750	621	0.0047
17	10,950	724	0.0045
18	10,725	723	0.0044
19	10,325	677	0.0045
20	10,400	658	0.0047
21	5,550	287	0.0058
22	9,525	561	0.0050
23	9,375	578	0.0048
24	9,175	552	0.0049
25	8,975	536	0.0050
26	9,375	575	0.0048
27	9,775	615	0.0047
28	5,375	276	0.0058
29	10,900	705	0.0046
30	10,250	651	0.0047
Total	283,250	17,608	Av. 0.0482

Table 3. Total Costs for Month

Fuel:	
283,250 cu. ft. of gas at 0.30c per 1000 cu. ft.	$84.97
Labor:	
2 engineers at $55 each	110.00
Oil:	
120 gal. at 0.19c per gal.	22.80
Interest, depreciation, etc., 15 per cent. per annum on $9,000	112.50
	$330.27

$$\text{Cost per kw.hr.} = \frac{330.27}{17,608} = 1.87\text{c.}$$

Toronto Section A. I. E. E.

The next meeting of the Toronto Section A. I. E. E. will be held in the Engineers' Club on Friday March 28. Mr. F. W. Peek, Jr., an assistant engineer to Dr. C. P. Steinmetz, will speak on "High Voltage Engineering."

Electric Trucks as a Power Load

Relative Importance of the Electric Truck as Compared With Other Classes of Central Station Business*

By H. W. Hillman

In the early 80's it was quite out of the question to even consider a subject of this kind. Certainly it was too early to think of a street railway load. It was a period long before miscellaneous heating devices and household utensils had been developed, and the splendid, ever-increasing industrial motor business was unknown to the central station manager. To-day, however, there is such a variety of electric devices and so many branches of business that need attention that it surely becomes interesting to analyze the relative importance of the more prominent classes, and to show why one class differs from another class in character and in importance.

What is it that makes one class of business more important than another class to the central station?

It is difficult to remember a time when central stations did not pursue the familiar policy of favoring "long hour" business. No one would think of questioning the policy, and so we are led to emphasize that electric trucks offer the desirable "long hour" business. As we advance with our argument, it will be found that this "long hour" feature stamps the electric truck branch as of far greater importance than many central stations have begun to realize. It was the "long hour" business which first attracted central stations to the industrial motor load. It was "long hour" business which led to such effective organization among the central stations in connection with power bureaus and industrial motor salesmen. Now it is a rare occurrence to visit a light and power company that has not vigorously promoted the motor business.

The National Electric Light Association has recently sent out some very interesting data relating to 114 motor installations. It was issued in book form by the commercial section and reflects great credit upon the work and activity of that body. Among the motor departments of all the central stations, it will be found of daily value. It is interesting while perusing this compilation carefully to note that 29 installations out of 44 which show load factor indicate that it is not over 10 per cent. Thus we see that it is not over three hours per day that the 29 installations are in service.

Long hour, uniform load

It is common knowledge that electric trucks are on charge six to eight hours each and every night, and surely we are warranted in claiming a marked advantage for the electric truck on account of such long hour business.

This load factor of 30 to 35 per cent. is uniform. It does not vary with the size of the truck nor with the number of batteries on charge, except, as has been forcibly brought out, that in a large size garage one-half of the installation can be charged the fore part of the night and the balance the latter part. By this practice the central station secures a 12 to 16-hour load of uniform character.

Next your attention is drawn to the "low demand" of the electric truck. For the same amount of plant equipment necessary to operate, the electric truck has eight and one-half times the earning capacity of the electric flat-iron. While it takes 86 irons to equal the annual income from one two-ton truck, the irons demand 51.6 kw. to operate, against 6 kw. for the truck.

For fear that some sales manager may question my comparison of the small electric iron with the large important truck, I have made comparisons with 12 classes of central station business other than the irons; that is, I have marched boldly into his camp with practically every branch of business associated with the electrical industry. Annual income per kw. of plant equipment necessary to operate 12 different classes of installations:

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*Read before the Electric Vehicle Association of America.

Installations.	Annual Income per kw.
1. One two-ton truck	$ 86.00
2. Residence, small	15.22
3. Retail store, small	31.75
4. Church	32.57
5. Industrial one-motor	43.16
6. Industrial two-motor	41.18
7. Industrial three-motor	19.61
8. Industrial eight-motor	50.96
9. Industrial twenty-motor	35.11
10. Residence, large	63.04
11. Drug store	118.40
12. Saloon	191.51

Above comparison is made from data recently secured from thirty central stations, showing average rate per kw.hr., monthly consumption in kw.hrs., maximum demand per kw. and connected load. Size of cities as follows:

1 in excess of 1,000,000 population.
4 between 200,000 and 500,000 population.
7 between 100,000 and 200,000 population.
8 between 50,000 and 100,000 population.
9 between 25,000 and 50,000 population.
1 less than 25,000 population.

The above table of comparison brings out clearly that the electric truck business stands at the head of the list as an income getter. . It stands at the head of the list in respect to the small demand upon the plant equipment, and again it stands at the head of the list for long hour business.

A good income getter

As a matter of fact it is unique in a great many ways. While the drug store and the saloon business apparently make the better showing, neither one nor the other possesses the broad extensive field which the electric truck business is bound to enjoy.

Glance for a moment at the five motor installations in the table. Who would have thought that electric trucks would make such an excellent showing when compared with the prize branch of the central station business; that branch, the rapid and extensive development of which has astonished the entire industrial world; a business now rich with power bureaus, power engineers, power solicitors and power accomplishments second to none in connection with the history of the electrical industry. Perhaps some one is wondering if the data is authentic and accurate. Let's read the note at the bottom of the table. Then we may surely feel that it is representative and practical, answering the purpose as set forth.

A house wiring campaign is a very common class of business for the central station manager to exploit. In a western city some 1,350 houses were wired during a period of 18 months. Only 67 extensions had to be made "off the lines" and only six solicitors were employed to promote this business. Many a central station has conducted a similar campaign, and has thus not only prepared the way for a large residence lighting business, but likewise arranged so as to easily promote business later, covering miscellaneous heating devices and household utensils.

Like the motor business, all of this work is admirable. But if the central station sales manager realized that only fifty electric trucks would produce the same annual income which is derived from 1,350 houses, would he start out boldly with six solicitors? Would he adopt an aggressive policy if some one should remind him that all the truck business could be taken on without the purchase of any additional plant equipment? Would he put on twice six solicitors if he actually realized the value of long hour business and the enormous field which is loudly calling for promotion and development? Will it encourage the central station sales manager to employ truck salesmen when he realizes that in the Newark territory 181 electric trucks have been placed in operation, with the excellent result that the automobile department showed a profit even during the year 1912?

Returning again to the point of "low demand." This is a feature of vast importance and perhaps can be emphasized most forcibly at this time by reminding you of the high demand of certain other classes of business and the effect upon the development and growth of such business. Let us consider the situation regarding an electric cooking and baking outfit for the residence kitchen. It advanced from the laboratory into the engineering department; from there into production, and was commercialized to a limited extent. But electric cooking and baking by electricity is not being extensively exploited. The demand is too high for the income possible.

The oven alone had a demand of 2.2 kw. With the addition of the meat broiler, the cereal cooker and the variety of necessary cooking appliances the demand would run as high as 5 kw.; to be conservative let us say 4 kw. This is two-thirds of the demand required for a two-ton truck, which has an annual earning capacity of $516. But the cooking and baking outfit has to compete with coal at $7 per ton, and at a special rate of 5 cents per kw. hour. My bills for five consecutive years averaged $5.66 per month in a family of five with one servant. In other words with two-thirds the demand the annual income would be about $68, against $516 for the truck.

Most energetic efforts have been made to lower this demand by utilizing the principle of the fireless cooker for conserving heat, but until this is effectually accomplished electric cooking among residences will not be extensively exploited because of high demand, because it does not possess the advantageous feature of low demand which the electric truck enjoys.

I want to emphasize this point of "low demand" still further by referring to another branch of business in connection with which high demand has held back development and commercial exploitation by the central station.

In building my house in Schenectady I wired completely with heavy feeders for a thorough test of electric house-heating. For months my furnace was not operated at all and entire dependence was placed upon the electric heating system. In six rooms upstairs one kw. each was required. In the large living room downstairs, three 1 kw. heaters were installed. The complete installation required 12 kw., or twice the demand of a two-ton truck. To compete with coal the annual income should not be more than $125 to $150 for heating that size of residence. Thus we see that with only one-fourth the income of the electric truck the demand would be approximately double. It would be a great burden on the central stations to exploit electric house-heating at the present time, for the reason of high demand. Such a class of business requires that the current be distributed into outlying territory. Even if generator capacity could be easily secured, or if it were at present available, extensions would be required all along the line, from the station to the incandescent lamp, including primary and secondary lines, transformers, meters, etc.

No distributing outlay

But this is not true regarding the electric truck business. It not only possesses the advantage of "low demand," but the current does not have to be distributed into the outlying territories. Without change of any of the system the business can be exploited. Neither a change in the distributing system nor a change in the station proper, not even increased generator capacity, because the batteries are charged at night.

Was there ever a branch of business possessing such splendid advantage? Is it any wonder that sales managers are beginning to organize to handle electric truck business aggressively?

Surely the time will come when house-heating and cooking and baking and innumerable other electrical fields will be thrown open for active exploitation, but to-day the path of least resistance leads to the electric truck class of business, and as related to all other branches which the central station deals with, there is no other of equal importance at the present time. But it needs more attention from the sales manager of the central station. It is a selling proposition.

I have shown that the current is abundantly available. We all know that electric trucks are thoroughly developed and successful as a commercial product. What the business needs is the benefit of the sales manager's experience, his judgment, his approval, his influence with the public, his influence with his own organization. Wherever this policy prevails, there we may look for progress.

Baltimore, for example, adopted this policy, and, better yet, has organized to push the sale of electric trucks. Besides the great advantage gained from the hearty support of the sales manager, there is an automobile department and its manager. He has a truck salesman, giving undivided attention to the subject. On a recent important deal five truck men were available, impressing the customer with the idea that the Baltimore company is intensifying the truck business. This is one of the reasons why upwards of 75 trucks have been placed by that company in a comparatively short time.

We appeal for the same intensity and activity which the sales manager puts into the subject of isolated plants. We appeal for the same character of literature which is found in the power bureau, which is distributed to customers and which reads something like this: "We will gladly send a motor engineer to your factory; we will make a test of your steam plant; we will submit to you a proposition showing the economy by the use of our motor service." That will imply that truck salesmen are available to send out; that they are posted to meet the arguments of competitors, and that they are educated regarding all kinds of batteries. Then will the electric truck business commence to boom. Then 30,000 motor trucks mentioned in one of your recent pamphlets will mount up to 300,000, and instead of 8,000 only being electrics, the ratio will be reversed; 225,000 will be electrics and the balance may be gas.

Campbellford, Trent Canal, a Power Centre

Two Hydro Electric Plants, Pulp Mill and Paper Mill—The Town and Surrounding Country Well Served

In the Electrical News of June, 1910, a description of the preliminary development works of the Seymour Power & Electric Company at Campbellford on the Trent Valley Canal was given in detail. At that time two generators had been installed and power was being transmitted to a number of points in the company's system. Since that date the Seymour Power & Electric Company has been included in the larger scheme of the Electric Power Company, the power development at this point has been completed and this plant has been tied in with all the other generating plants of the Electric Power Company on their 44,000 volt distribution loops.

The power house at Campbellford is situated at what is known as Stephens' Dam. This power plant started up in December, 1909, with two 600 kw. generators and 22 miles of 44,000 volt transmission line to Delora. The power developments in this area have been so rapid that the company proceeded to complete the installation as quickly as possible and the power house now contains five 600 kw., 2400 volt, 60 cycle, 3-phase, 150 r.p.m. vertical shaft generators. The general appearance of the completed power house is shown in one of the photographs herewith.

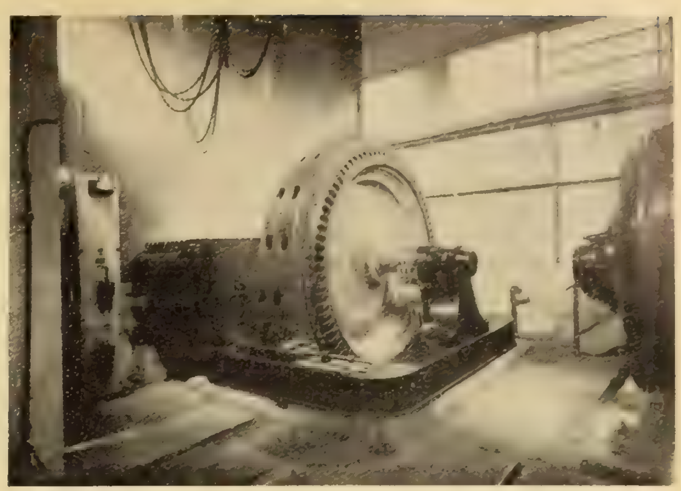
In addition to the above mentioned generator the power house also now contains one 60-kw. vertical shaft, turbine exciter, 125 volts; one 75-kw. induction motor-driven exciter, 125 volts; four 1125 kv.a., 3-phase, water-cooled transformers, 2400/44000 volts; two out-going 44,000 volt lines connecting to the Electric Power Company's system which now comprises about 300 miles of 44,000 volt line and twenty-two 44,000 volt sub-stations, together with several other power houses which have been described from time to time in the Electrical News.

The demand for power over this area has increased at such a rate that it has also been found advisable to utilize a water development owned and operated by the town of Campbellford. To this end arrangements were made be-

Power house, Seymour Power & Electric Company

Campbellford municipal power house

Seymour Power & Electric Co.—Five 600 kw units



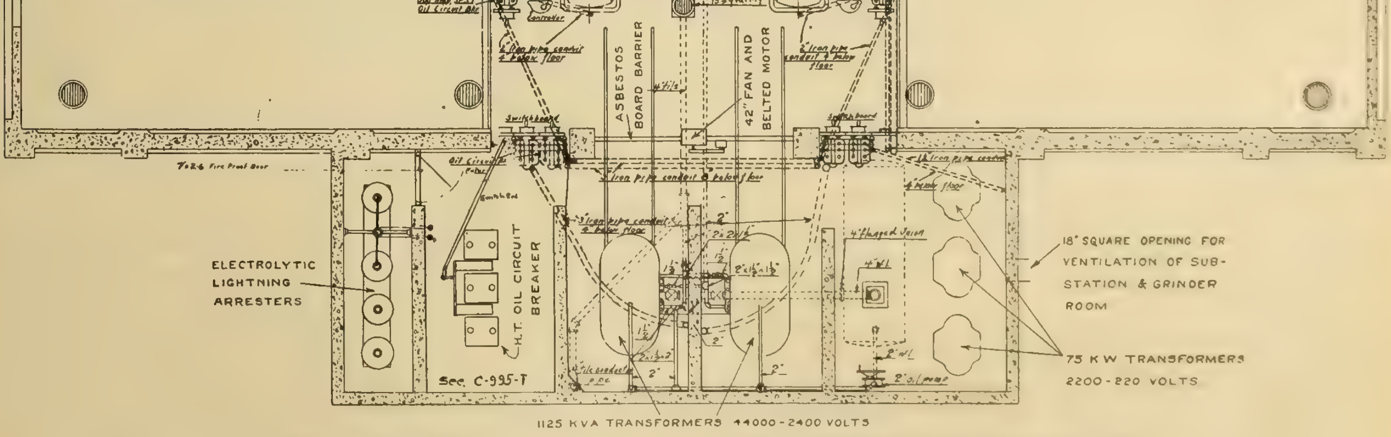
Motor equipment, Northumberland Pulp Company

tween the Electric Power Company and the town whereby a 1,000 kw. generator was installed in the town power house. The power so generated is transmitted to the step-up transforming station at the company's own generating plant at Stephens' Dam, where it is also used to feed the 44,000 volt lines of the main system. This machine is of Swedish General Electric manufacture.

An interesting feature of the power demand in Campbellford has reference to the requirements of the mill of the Northumberland Pulp Company, a subsidiary of the Electric Power Company. This mill is situated about three miles from the generating plant and current is supplied to it from the 44,000 volt line. The voltage is here stepped down to 2400 volts by means of two 1125 kv.a. 3-phase water-cooled transformers. These transformers feed two induction motors, one 600 h.p., 2400 volt unit, C.G.E. type, and one 1,000 h.p. 2400 volt Swedish General Electric unit. Both of these are direct-connected to pulp grinders. All the smaller machinery in the mill is also motor driven, including such equipment as centrifugal pumps (requiring one 25 h.p. motor direct-connected to each of two pumps); wet machines; barkers; conveyors; centrifugal screens, etc. All the smaller motors are 220 volt machines and of 75 h.p. capacity or under. Current for these is supplied through three 75 kw. 2200/220 volt self-cooled transformers.

In the initial plan of this pulp mill no special provision was made for preventing the moisture from the pulp grinders working its way back to the motor and transformer compartments and as a result difficulty was encountered in maintaining proper insulation in this equipment. The difficulty was later overcome by the installation of a 42-in. motor-driven fan located in the partition which separates the pulp mill sub-station from the grinder room. This fan draws air from outside the sub-station building and delivers it into the grinder room so that it now serves the double purpose of cooling the transformers and keeping the steam and moisture away from the motors and transformer equipment. The pulp company use about 2,000 h.p. continuously for 24 hours each day.

The Northumberland Paper & Electric Company, of Campbellford are another industry which have recently electrified part of their mill and now use four 50 h.p. induction motors on beaters and two 75 h.p. induction motors on Jordans in addition to several smaller motors for conveyors, etc., taking in all about 300 h.p. This is supplied by the



Layout of substation, motor and grinding rooms—Northumberland Pulp Company

Electric Power Company from the same sub-station that furnishes power to the Northumberland Pulp Company.

The value of this type of load on any electric system is shown by the unusually favorable load factor now maintained by the Electric Power Company throughout their entire system. The peak load on this system has grown very rapidly and in December, 1912, just three years after the Stephens' Dam power house commenced operation with a load of 300 h.p., the peak had grown to 15,000 h.p. with a daily load factor usually exceeding 80 per cent.

This load of 15,000 h.p. is very close to the total generating capacity of the system and arrangements have been made with the Northumberland Pulp Company, that, when necessary, their load can be pulled off for a short time when the peak on the total system threatens to overload the generators. This, at the worst, is only for a couple of hours a day during the shortest days of the winter season. Within the last few weeks the new power house at dam No. 5, at Frankford which is about five miles north of Trenton on the Trent Valley canal has been placed in commission and now contributes about 4,000 h.p. to the total generating capacity of this system. This installation consists of four 650 kw. 6600 volt, 60 cycle, 3-phase vertical shaft, Swedish General Electric generators, each driven by a 1,200 h.p. Boving turbine. Other electrical equipment includes one 75 kw. turbine driven exciter; one 75 kw. induction motor driven exciter and switchboard equipment furnished by the Monarch Electric Company of Montreal. No sub-station has been built at this point but power is transmitted at the generated pressure of 6600 volts over four circuits of 300,000 c.m. stranded aluminium cable to the transforming station at dam No. 2 which was described in the June, 1912, issue of the Electrical News. Sufficient transformer equipment has been supplied at this point to take care of all the power generated at both dam No. 2 and dam No. 5 and step it up to 44,000 volts. The recent addition at this point of a 3,000 kv.a. step-up transformer brings the present capacity to 9000 kv.a. in three 3000 kv.a. units.

Anticipating continued rapid increase in the power demand in central Ontario the Electric Power Company are also pushing forward to completion the Healy Falls power house development which is situated on the Trent River six miles north of Campbellford. At this point there is a head of 76 ft. and the power house is designed for four 5,600 h.p. turbines each of which is to be direct-connected to one horizontal shaft 3,750 kv.a. 60 cycle, 3-phase, 6600 volt generator. The equipment which will be immediately installed in this power house and which is already on order consists of two 5,600 h.p. Escher Wyss turbines; two 3,750 kv.a. C. G. E. generators; one 160 kw. turbine driven exciter, C.G.E. type; one 160 kw. induction motor driven exciter, C.G.E. type, and three 3,750 kv.a. 3-phase transformers 6600/44000 volts supplied by the Canadian Westinghouse Company. Switching equipment for the above apparatus and two 44,000 volt outgoing lines will also be supplied by the Westinghouse Company. It is expected that the Healy Falls plant will be sufficiently advanced to carry next winter's peak load.

Toronto's Hydro Electric Distributing System

By Mr. J. G. Jackson

The construction work on the distribution system of the City Electrical Department, later the Toronto Hydro-electric System, was started, so far as the general plans, etc., were concerned, in the latter part of 1908. Actual construction on the underground sections commenced in August, 1909. The major portion of the work, however, was done from 1910 to 1912.

The system consists of eight substations, fed from a 13,200 volt bus in the Toronto station (Strachan avenue) of the Ontario Hydro-electric Power Commission: a 2200/115-230 volt distribution system for general lighting, with incidental power at 550 or other voltage; a street lighting system; and a 13,200/550 volt three-phase power network.

The major portion of the distribution is accomplished by means of overhead construction. A considerable portion of the business section, however, is covered by underground.

General

In designing the distribution system, the following points were kept in view. It was necessary to supply a waterworks pumping load with a total connected capacity of 14,375 h.p., comprising 8,925 h.p. for general pumping and 5,450 h.p. for fire and other occasional purposes, the load being taken at three different stations; total maximum demand equals 7,650 h.p. A street lighting system was to be provided to supercede a system consisting of ancient arc lights, together with intermediate gas lighting. Also provision was to be made for the supplying of light and power at any point in the city so far as practicable.

The city covered an area of 28 square miles, approximately the greatest dimensions being 10 miles long and 4 miles wide, with a total of approximately 412 miles of streets. The load to be provided for on account of the waterworks and street lighting could be easily determined. For the general lighting and power load, however, it was necessary to design a system upon which it would be possible to connect with the least inconvenience almost any load which might occur. So far as any other than exceptional loads are concerned, this was best accomplished by the provision of a secondary net-work of such capacity as would be expected to supply the total load existing at any point. The fact that the distribution system was being constructed before the loads were actually secured made necessary a liberal capacity in the initial installation, as well as such flexibility as would make it possible to take care of rapidly growing loads, in any district, with the least possible delay.

Primary and Secondary Voltages

13,200 volts was chosen as the general transmission voltage, upon consideration of the distances to be covered, and in view of the fact that this voltage was being standardized for their system by the Ontario Hydro-electric Power Commission. It has also considered that 13,200 volts was sufficiently low to permit of its utilization for general distribution purposes. 2200 (or 2300) volts was decided upon as an intermediate primary voltage for lighting and power distribution, as it was intended that the feeder lengths would be sufficiently short to permit satisfactory operation with this voltage. This also made it possible to connect 2200 volt motors directly to the primary lines.

In this connection, it might be noted that an investigation to determine the proper voltage for the waterworks pumping, the motors ranging from 500 to 1500 h.p. sizes, indicated that the efficiency and cost of 13,200 volt motors as against 2200 volt motors and transformers would be practically identical, with a tendency on the part of the manufacturers to favor the lower voltage.

Secondary lighting and power voltages of 115 volt and

230 volt single phase and 550 volt three-phase, were of course determined by the voltage of the loads to be supplied.

Stations and Station Details

The eight substations provided were located at such points as would make the intervening distances as nearly equal as possible, and at such points as were suited for waterworks purposes. The station structures were erected by contract, but all electrical construction, including pipe and duct lines, cable works, switch structures, switch installation, and switchboards, including the panels, etc., were designed and erected by the staff, as it was considered that the particular characteristics in design, and class of workmanship, together with low cost and quick results could be obtained in this way.

The stations in general contain 13,200 volt switching equipment for the main feeders from the terminal station to the substation, supplying such busses in the substation, from which 13,200 volt sub-feeders were taken off, either for lighting and power transformers in the station, or for sub-feeders to other points. The 13,200 volt bus arrangement at the terminal station was laid out as a double ring. Each transformer bank of the original installation fed a separate bus section, the sections being tied by means of sectionalizing oil switches, and each feeder and transformer bank being equipped with two "H" switches to permit the selective connection of either the main or the emergency bus. This arrangement makes it possible to kill any bus without interrupting the service, and to disconnect any transformer bank feeding its bus section from the sectionalizing switch.

The 13,200 volt busses in the substations consist of two or more sections, connected by busses to switches, each section being supplied by one or more feeders, such feeders from these busses being equipped with a single oil switch, mainly of the Westinghouse "E" type.

The less importance of the substation busses, and the fact that most of the loads supplied by these feeders are fed by more than one feeder, was considered to justify the omission of an alternative bus. The bus to switches, however, made it possible to feed any bus section from other than its own particular feeder. In the case of long feeders looping through all or several sub-stations an incoming and outgoing "H" switch was provided in each station, together with a substation feeder switch, making a "T" connection to a short bus between the incoming and outgoing switches.

Brickwork and reinforced concrete slabs have been used entirely for cell construction. The size brick used not being, 8¼ in. x 4 in. x 2¼ in., standard in this country, it was necessary to have it specially burned. In view of the fact that vitrified brick of the proper characteristics could not be obtained locally, softer pressed brick was employed. No serious chipping of the brickwork has, however, resulted. The slab work was made up as required, and was principally 1:2:4 mix, 2 in. thick, and costing approximately 18 cents per square foot. Doors were made of asbestos board of ¼ in. thickness, on 16 in. x 7 ft. 6 in. frames, the panels in front of the disconnecting switches being wire glass, thus permitting easy inspection.

Busses are of 2 in. x ¼ in. flat copper, and jumpers of 1 in. diameter copper tubing 1-16 in. wall. It was considered that a more satisfactory structure, and with more pleasing appearance would be obtained by the use of brick rather than concrete, as previous experience with concrete structures had indicated that particularly accurate form work and workmanship was necessary in order to produce a satisfactory structure, and that it was more difficult to do any cutting or make any alterations to the structure at any time afterward. Considerable difficulty was, however, experienced in getting the bricklayers up to the point where they would lay a reasonable number of bricks per day. The pressure brought to bear upon them resulted in a number of visits from the "walking delegate." When it was pointed out to him, however, that the rate which the bricklayers apparently thought sufficiently great figured out to 65 bricks per day, or approximately one brick in every 7½ minutes, the result was that it was found possible to lay approximately 200 bricks per day, per mason. This, of course, included the laying of slabs, setting of fastenings, cutting for conduit work, etc.

2200 volt Black Monson slate panels are provided on the 2200 volt switchboards and high tension control panels, the 2200 volt panels being 18 in. wide, and high tension control panels 12 in. 2200 volt switches up to 300 amperes capacity, are mounted on the back of the slate panels. Masonry structures with barrier walls are provided in the basement under the 2200 volt structure for the purpose of mounting disconnecting switches, etc., and also the heavy oil switches which cannot be conveniently accommodated on the switchboard panels. Control panels carry the necessary instruments and control switches for operating the high tension equipment. A 125 volt 40 ampere-hour storage battery with a 200 ampere discharge rate for 1 minute, is provided in each station for the operation of the switches, signal lamps, and emergency lighting.

To protect the lamp circuits from high voltage during the charging of the storage battery, all lamps are connected to a third bus, which is arranged to be ordinarily in parallel with one side of the main control bus. The throwing of the battery switch for connection to the motor-generator set when charging, separates the lamp bus and connects it to Cell 55 of the battery. All switchboard wiring is asbestos covered.

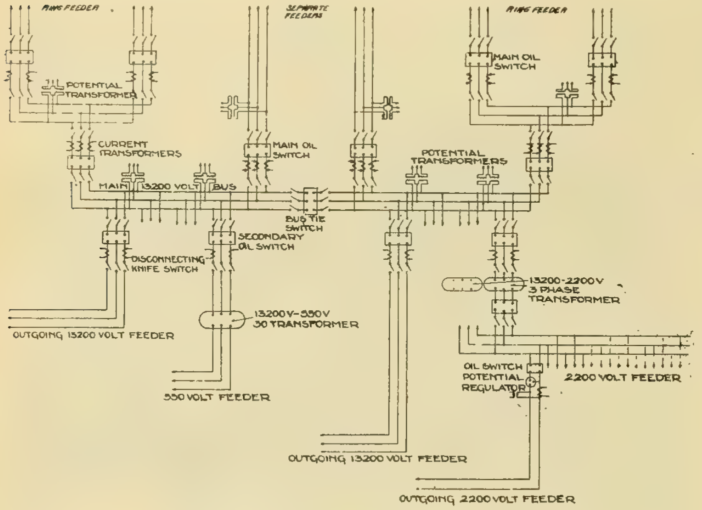
Standard Toronto H. E. transforming station

General Lighting

The average length of the feeders worked out at 12,000 feet of which 3,000 feet consists of the distributor portion, to which the transformers were connected, and 9,000 feet of feeder from this point to the substation. The simple form of primary adopted makes it possible to operate long sections of the primary as the single feeder, breaking up such sections later by simply cutting the distributor into such lengths as the load might require, and running additional feeders to these points. Comparisons of the investment and the fixed charges as against losses, resulted in the fixing of the primary size at 3/0 for an assumed loading of 180 amperes. The No. 2 secondary bus parallels the primary, the No. 2 secondary being determined by the fact that with the sizes of transformers provided for, the dropping off of one transformer when feeding through the next transformer would, under full load conditions add only 1 per cent. to the secondary drop.

The secondary wiring on the side streets consists of Nos. 6, 4, and 2 outers, with occasional larger sizes, the neutral being almost in all cases No. 4 on the main feeders, and No. 6 on the cross streets, being mainly No. 4 on the streets at right angles with the primaries, and No. 6 on the cross streets. These sizes of secondary wiring were determined by the average loading assumed, and the allowance of a maximum secondary drop of 3 per cent. Comparisons were made between the sizes of copper which would result in this drop for the assumed loadings and larger sizes, and it was determined that this was practically the most economical point, particularly as the loadings might be different from those assumed. Any error in size resulting from this could be, in general, easily corrected when the loading developed, as double side wiring was provided for, and single side installed until the development of the load.

All transformers are provided with fuses on the primary side only, and are connected solidly to the secondary bus, which is broken at intervals, intended in general to cover 4 or 5 transformers, these secondary breaks being arranged for fusing in case it appears that any improvement in regulation or saving in capacity would result from a tie. No other fusing than for bus sectionalizing are provided on the secondaries.



Wiring diagram of typical substation

The lighting transformers in general range in size from 15 to 30 kw. capacity, the general size assumed in the layout being 25 kw. Transformers are installed as nearly as possible at the junction of the service to the cross streets with the primary lines in order to avoid drop. Neutrals are grounded at all transformer poles by means of a ¾ in. galvanized pipe driven 6 feet into the ground. As the neutrals are practically continuous, there may be a thousand or more such grounds in parallel. This has proven very effective. Ground wires are provided at each transformer pole, the transformer cases being grounded to this wire, to which the lightning arresters are also connected, thus resulting, in a direct path from the ground side of the lightning arrester to the transformer case.

Street Lighting—Overhead District

It was determined to use tungsten street lighting, mounting a lantern fixture on the concrete poles. For this purpose a ½ in. pipe was provided in the pole, with a nipple extension for securing the fixture and carrying the wires. A condulet was provided at the top of the pole. A series multiple system using 10 lamps on 220 volts was originally contemplated, thus requiring 2 outers and a series wire. Owing in part to the lack of flexibility of this system, as well as to the probability that the standard 110 volt lamp would improve, a straight multiple system with 110 volt lamps was installed.

The wiring to the lamp consisted of two extremely flexible No. 16 rubber covered wires, of 31 strands, tied solid to the neutral and one of the outer wires of the street lighting secondary. A three-wire secondary was required, the neutral being common however, with the residence lighting secondary. All secondaries are No. 6, with the exception of the common neutral. All primaries are No. 2. The distance between feeders is 3,000 feet. Transformers are mostly 10 and 15 kw. There are 16 feeders of 200 amps. normal rating. No regulators are provided.

This system compares favorably with the series wiring for an arc or other series system, although two additional wires are required besides the tie to the residence lighting neutral. While a single wire would in some cases be possible for the series system, the 200 kw. or more capacity of the feeder greatly reduces the number of wires required for the return circuit to the station, and as this comprises a very considerable part of the total wiring, the saving in pole space seems apparent.

Overhead System

The overhead system consists mainly of the 13,200 volt feeders on wooden pole lines; the 2200 volt feeders, covering approximately 20 per cent, of the streets and on wooden pole lines; the secondary lines, which, in general, are of concrete poles.

The primary lines on parallel streets, such as Queen St., College, Bloor St., Dupont, etc., spaced approximately 3,000 feet apart, carry both street and general lighting primaries, and are provided with three six-pin cross arms. The primaries on streets approximately one-half way between these points carry only general lighting primaries, and are provided with two six-pin cross arms. The primary pole lines have been constructed, in practically every instance, to overbuild any obstruction such as trees and lines of other systems.

It has been possible to build the secondary lines on short poles, as possible contact of 220 volt circuits with trees, etc., would not result in any particular troubles.The short cross arms or brackets on the concrete poles are provided with 6-pins, of which the upper and outer on the street side are used for street lighting, the three on the inside being employed for general lighting, and the neutral for street lighting as well. The sixth pin makes it possible to run a power leg, giving three-phase 230 volts with the two outer general lighting wires.

All wooden poles are stepped. Cross arms are treated in a carbolineum tank. All hardware used is heavily galvanized, and in general is heavier than that ordinarily listed for this purpose. All cross arms are held with ¾ in. through bolts. Poles are painted with a single coat of good paint. Specifications for wooden poles are practically standard. An effort has been made to obtain straight poles of good appearance.

The fact that the streets were occupied on both sides by other lines before this system was started, resulted in considerable difficulties in obtaining clearances for poles and lines. In the case of transformers, in order to avoid entanglement with other lines, the primary and secondary lines were brought down to the transformer from the top of the pole in 1¼ in. conduit, with condulet openings at the top and bottom. On the primary side, the leads to the conduit consist of rubber insulated spark coil wire, tested to over 26,000 volts. This is tied directly to the primary overhead, the fuses being placed at the transformer. The size of wire is such that it was expected, in case of any trouble, it would be possible to burn out the spark coil wire at less than the capacity of the feeder. It may be remarked that, although this produces a very neat transformer connection, considerable trouble developed later, owing in a large part to the defects resulting from inferior wire having been installed owing to various reasons.

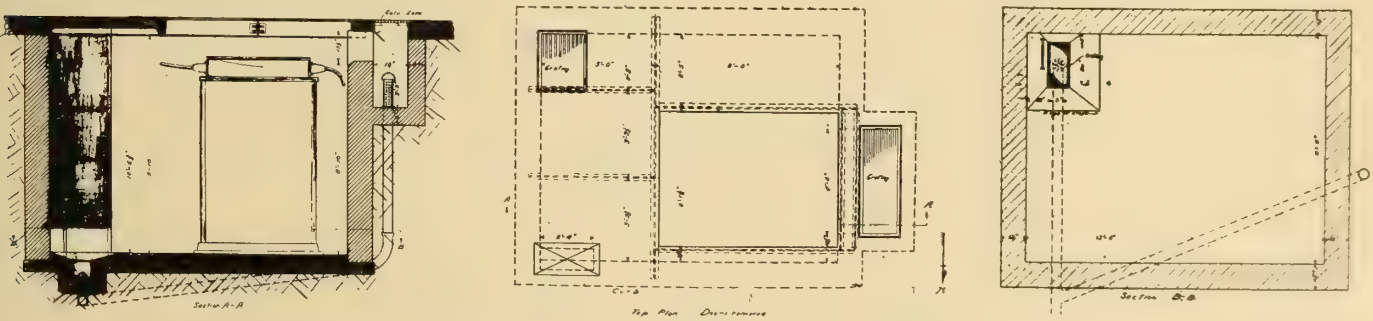
Breakers in secondary lines were made by means of egg-shaped porcelain insulators, the breaks in bus lines being arranged with lugs, so that an open link aluminium fuse could be used to bridge the insulator. No. 6 galvanized iron ground wire was used on transformers, connecting to the ground pipe driven in at the base of the pole.

The secondary fuses have been omitted as far as possible on the street lamps. It was considered at an investment of 25 cents per pole for fusing, totalling about $9,000, that the annual fixed charge on the investment would be very considerably greater than the actual damage due to burn outs of lamps and wiring resulting from lack of fusing. In addition to this it was felt that a multiplicity of secondary fuses would result in only a greater number of points from which trouble could arise.

Typical sub-station for large consumer—Built of 1 inch concrete slabs

All connections at substations to the overhead 22000 volt lines are made underground in cable, with potheads at the terminal poles. No trouble has been experienced on these cables.

Lightning arresters are installed at every transformer, and at the junctions of the overhead with the underground, except that transformers in the central district of the city are not provided with lightning arresters, on the assumption that the buildings and columns of heated air and smoke would effectively shield these locations. This has apparently been demonstrated to be correct.



Typical transformer pit showing plan of pit and ventilating system

13,200 volt pole lines have been constructed in so called "Ring Mains" consisting of two circuits of 250,000 c.m. cross section aluminium, 13,200 volt lines. The construction adopted consists of three cross arms, with the lines of each circuit arranged vertically, and with similar phases on each arm, the result being that wires thrown over the line will not necessarily result in a short circuit or other trouble. A No. 2 aluminium ground wire mounted in a bracket and clamped to the pole top is carried throughout the entire distance. Two additional No. 2 aluminium ground wires are carried on the cross arms on either side of the pole for one-half mile in either side of the station. Ground wires are grounded at every pole by means of a No. 6 galvanized iron wire running down the pole and tacked to it. These wires are connected to all the pole hardware, with the exception of the steps, and are grounded to a 1 in. galvanized iron pipe, 7 feet long, driven 6 feet into the ground.

Entrances to the substations from the 13,200 volt overhead lines are made by means of passing through concrete roof entrances, with cast concrete caps. The wiring on the roof is carried on pipework. No difficulties have been experienced from leakage or condensation at the roof entrances.

Underground Construction

A total of approximately 600,000 duct and pipe feet of conduit have been installed, in lines ranging from single pipe to 36 duct runs, and there are 171 manholes. The conduit structures in general are only three ducts in width. For duct work 3½ in. single clay duct has been employed. The ducts are surrounded by 3 in. walls, with 4 in. base and top, of 1:3:5 concrete mixture. Adjacent ducts are staggered, and all ducts are laid in a full bed of mortar of 1:2 mix, thus resulting in an extremely strong structure. No mandrils were employed in the laying of ducts. Ducts were tested and cleared, so far as possible, the same day they were laid, to prevent the formation of any obstructions. All conduit runs were graded in one direction only, with a minimum grade of 2 in. to 100 ft. No high or low spots were allowed between manholes.

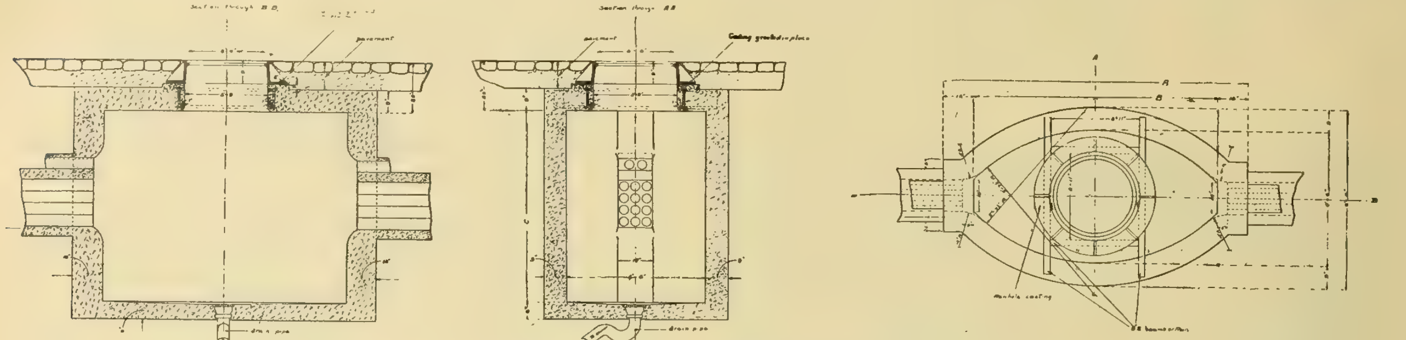
Manholes were designed, as far as possible, to prevent sharp bends in the cables. For this reason, in practically all cases a 14 in. sweep in the wall was preserved at duct entrances, so that no corners were produced into which or about which cables could be bent. All manholes were provided with sewer connections, and with a ground pipe driven 6 feet into the soil under the manhole. All manholes are of brick construction, with 8 in. concrete roof, and 6 in. concrete floor. Manhole covers are of cast iron, provided with a number of holes to assist in ventilation. The average cost of conduit construction of tile duct has been approximately 20 cents per foot.

Cables in manholes are carried on, mainly, a single row of cast iron hangers. All cables 2200 volt and higher are wrapped with ¼ in. asbestos tape, held by a fireproof cement. The asbestos covering of the 13,200 volt cables is painted red. No. 2 copper ground wires are wired to all cables and can be connected to the ground pipe, or grounded by the waterpipe where this is available, if tests at any time show that this is necessary. Cable records are made on cards showing manhole faces, etc. All cables are tagged.

550 Volt Network

For dense power loads, covering a considerable district, there is a 550 volt net work lay-out, fed by 13,200 volt subfeeders, fed from the sub-station busses. Each feeder is controlled by one oil switch on the sub-station bus, and terminates in a transformer pit, supplying a 13,200/550 volt transformer of minimum size of 500 kw. On the secondary side these transformers are provided with main disconnecting blades, and branch fuses mounted in feeder pillars.

The transformers are mounted in special transformer pits, arranged with air inlet and down shaft on one side of the pit, and a ventilator on the top at the opposite end, the air inlet and outlet being covered by iron gratings. These are built under the sidewalks or in other available spaces.



Toronto's underground conduit system—Standard two-way manhole

Transformers employed are water cooled, but results obtained in ventilation of these pits indicate that a self-cooled transformer could be used. It was originally considered desirable to arrange for the drainage of the water coils of the water-cooled transformers mounted in these pits, so that the water would not freeze up in winter time. To determine the variation in temperature, recording thermometers were placed in manholes in which no cables were being operated, and the minimum temperature of 31 F. to 32 F. degrees were obtained, with the temperatures down to 10 degrees below zero outside.

This system of 13,200/550 volt distribution, with secondary network and transformers, is thought to present considerable possibilities.The transformer capacities and cost of same, together with transformer pits, fuse boxes, etc., are considerably less employing units of 500 kw. or more than would be the case with the usual primary distribution and transformers averaging not more than 50 kw. in size. The size as well as the cost of a pit for a 500 kw. transformer would not be very much more than in the case of a 50 kw. transformer. The boxes also, while somewhat more expensive, would be very much less in number. It is also possible to do with somewhat less transformer capacity than would be possible in cases even with a secondary network fed with a large number of small transformers. The transformer capacity as compared with small transformers each supplying a separate secondary, is, of course, very much less.

Primary losses and drops with 13,200 volts are almost negligible. Transformer efficiencies can be maintained at approximately 98 per cent. The costs per kilowatt are approximately one-half that for transformers of 25 to 50 kw. capacity. Very good secondary regulation can be maintained by the dropping in and out of feeders with variation in load, as would be in the case in a d.c. network. As the load falls off transformers can be dropped out with the result that the remaining transformers continue to be fully loaded, or nearly so, thus eliminating transformer regulation. A secondary regulation within 2 per cent. is considered quite possible. Voltage regulation at the station 13,200 volt bus could not, of course, be compensated for in this way to any extent. The switching in and out of transformers and feeders on the primary side of the variation in load obviously would produce very little effect on the cable or transformers; in fact it appears probable that the distribution of a system of this sort would be considerably less as a result of the common secondary network.

A No. 4 13,200 volt paper-insulated cable, approximately 2 in. in diameter is employed on the feeders to these 13,200/550 volt transformers. The cost of this cable is approximately the same as for a 3/0-2200 volt cable, which has approximately 1-3 of the capacity. The I^2R losses and drops also, over the 13,200 volt cable, are obviously very much less. The difference in cost for cables for duct lines only 3,000 feet in length, are found to amount to $7.50 per kw. delivered, in favor of 13,200 volt feeders. The network system of this sort will, of course, increase in efficiency and possibilities of regulation as the number of feeders is increased. It is considered quite possible to obtain an efficiency from the substation to the consumer's service of in the neighborhood of 90 per cent. when fully loaded. The reduction in coil losses by the elimination of the unnecessary transformer is also an advantage.

This 550 volt network provides a voltage at which motor loads can be taken off directly, and which can be considered as a primary for lighting services, individual transformers being connected to the 550 volt lines.

A very good advantage resulting from the employment of this voltage as a primary rather than from a higher voltage. is that it is quite possible for a jointer to open up a three-phase cable and connect up a service to a transformer without any very difficult precautions. All jointers are equipped with rubbers boots without nails, and with rubber mats upon which they sit, on the edge of service boxes, etc. The 550 volt system is not grounded directly, but is connected to earth through 550 volt lightning arresters or spark gaps.

Summary of General Data

Length of city	10 miles
Width	4 miles
Length of streets	412 miles
Total poles required	40,000
Concrete	30,000
Wooden	10,000
13,200 volt pole lines, including Island,	20 miles
2200 volt primary pole lines	74 miles
Duct, pipe and laterals	599,271 feet or 113 miles
Lanterns	39,000
Cluster lights	500
Underground cable, total	50 miles
Overhead wire, including secondary and primary wiring	4,500 miles (approx).
Sizes of wire and cable:—	
Wire, 13,200 volt overhead	250,000 c.m. aluminium No. 0 aluminium
Wire, 2200 volt overhead	3/0 copper No. 2 copper
Wire, secondary.	No. 6, No. 4, No. 2 & 250,000 c.m. cop.
Cable, 13,200	No. 3/0 and No. 4 copper
Cable, 2200 volt	No. 3/0 and No. 2 copper

Effects of Temperature on Insulations

By C. P. Steinmetz and B. G. Lamme[*]

The problem of permissible temperature limits in electric apparatus is largely that of the durability of the insulation used. As this may consist of materials of widely varying heat-resisting qualities, the problem resolves itself into one of consideration of the properties of the materials themselves.

The durability of insulation may be considered from two standpoints, the mechanical and the electrical. Tests and experience have shown that temperatures which may ruin the insulation from a mechanical standpoint, may not radically affect its di-electric strength. This is particularly true with moderate voltages where the insulation serves largely as a separating medium. The purpose of the insulation usually is two-fold; First, it must serve to separate, mechanically, the electric conductors from each other, and from other conducting structures, and second, it must withstand the voltage between the electric conductors and between the electric circuits, and other conducting parts. In lower voltage apparatus, usually only the former function applies, as the mechanical separation is more than sufficient to withstand the voltage used. The dielectric strength of the material is, however, of first importance in high voltage apparatus.

A great majority of the electrical "breakdowns" on low voltage apparatus is due to mechanical weaknesses, as far as the temperature problem is concerned; that is, high temperatures may make the insulation brittle, or crisp, so that it may flake off, or powder, or crack, or be crushed by mechanical action, thus allowing the conductors to make contact with each other or with adjacent conducting material.

The "life of insulation" is an indefinite term and must be defined in time, mechanical strength, absence of foreign materials of a conducting nature, etc. Almost all insulating materials will be somewhat affected in time, and many of them tend to become dry and brittle. The rate at which deterioration occurs with any given material, is some complex function of the temperature and of other conditions.

Classes of Insulations

Insulations may be classified under three headings, depending upon their heat-resisting properties. However, all such classifications must be relative, for no absolute limit can be fixed, as there is no definite point at which injury or destruction can be said to take place.

The usual insulating materials can be considered as included in three general classes:

Class A. This includes most of the fibrous materials, as paper, cotton, etc., most of the natural oil resins and gums, etc. As a rule, such materials become dry and brittle, or lose their fibrous strength under long continued moderately high temperature, or under very high temperature for a short time.

Class B. This includes what may be designated as heat-resisting materials, which consist of mica, asbestos, or equivalent refractory materials, frequently used in combination with other supporting or binding materials, the deterioration of which, by heat, will not interfere with the insulating properties of the final product. However, where such supporting or binding materials are in such quantity, or of such nature, that their deterioration by heat will greatly impair the final product, the material should be considered as belonging to Class A.

Class C. This is represented by fireproof, or heat-proof materials, such as mica, so assembled that very high temperatures do not produce rapid deterioration. Such materials are used in rheostats and in the heating elements of heating appliances, etc.

All the above are relative terms. The first class, for instance, represents materials which are really more or less heat-resisting, but which deteriorate at lower temperatures than those in the second class, which are defined as heat-resisting. Also, the fireproof materials of the third class are not strictly heat-proof or fireproof, but will simply withstand very high temperatures for relatively long periods without undue deterioration.

In Class A, the materials appear to have a very long life (or an almost indefinitely long life, aside from mechanical conditions) if subjected to ultimate temperatures which never exceed 90 deg. Cent. Also, they appear to have a comparatively long life, even at ultimate temperatures as high as 100 deg. Cent. At materially higher temperatures than 100-deg. Cent., the life is very greatly shortened, and temperatures of 125 deg. Cent. will apparently ruin the insulation, from a mechanical standpoint, in possibly a few weeks, if such temperature is maintained steadily. However, for low voltages, the insulating qualities may still be very satisfactory, even at this temperature, and therefore the destruction of the insulation is purely one of injury or breakdown from the mechanical standpoint, as stated before. Temperatures as high as 160 deg. Cent. on such insulations for a considerable period may not entirely destroy their insulating qualities, although, mechanically, such temperatures appear to be impracticable, except for very short periods.

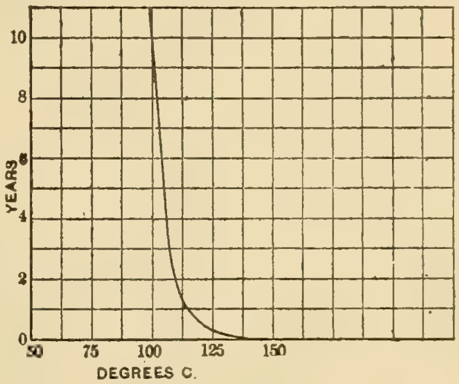


Fig. 1.

In order to illustrate the relation between the possible life and temperature of Class A insulation, Fig. 1 is shown. This must not be taken as representing actual results, but is simply intended to illustrate, in a very approximate manner, the very great shortening of the life of insulation by increase in temperature.

It may be assumed that at very high temperatures, the insulation will have practically the same life, in actual hours of high temperature operation, whether the temperature is applied continuously or intermittently. For example, if an insulation has 10,000 hours life with a certain high temperature continuously applied, it is assumed that it will also stand the same temperature for 10,000 hours in short periods, provided the intermediate temperatures are low enough to represent an indefinitely long life. It is probable that under intermittent condition, the life will really be slightly greater, due to the fact that depreciation will be largely mechanical, and the insulation may "recover," in some of its mechanical characteristics after each period of high heating.

If, therefore, high temperatures are reached intermittently, with intermediate periods of lower value but still high enough to shorten the life of the insulation, it may be assumed that the total life of the insulation is the resultant of the life under the two temperature conditions.

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[*] Presented before A. I. E. E. New York Convention

In heat-resisting materials, such as those of Class B, temperatures of 125 deg. Cent. are comparable with 85 deg. Cent., or 90 deg. Cent. in Class A, and 150 deg. Cent. in the former is comparable with 100 deg. cent. in the latter. Fig. 2 illustrates very approximately the life-temperature curve of such insulations. As in Fig. 1, this should not be taken as an exact representation of the actual life. Due to the greater heat-resisting qualities of such materials, it appears that relatively higher temperatures are not as quickly harmful as in the first class.

In Class C materials, it is difficult to give any reasonable indication as to the limits of temperature, except that very high temperatures (practically up to the point of incandescence) are found in some heating appliances.

Temperatures and Flow of Heat

As the insulation, in itself, is not usually the seat of generation of loss or heat, it is the temperature of adjacent materials which must be considered in defining the conditions in the insulation. The temperatures of the adjacent materials should therefore be considered only in so far as they affect the insulation itself, and where such temperatures do not affect the insulation, or the life of the apparatus, or its normal performance, they are immaterial.

Considering the influence of the temperatures of the adjacent media, the direction and amount of heat flow must be taken into account, as the maximum temperature in the insulation is dependent upon these. In the case of armature windings, for instance, the heat flow may be from the buried portion of the coils toward the end windings. It also may be from the buried copper through the insulation to the armature teeth, or there may be a reverse heat flow from the iron to the copper, depending upon the various factors of construction, heat conductivity of the materials, amount of heat generated in the various parts, ventilation, heat dissipation, etc.

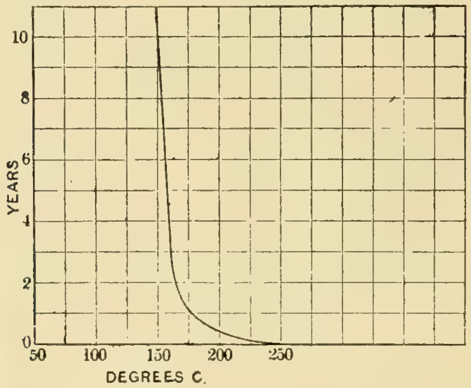


Fig. 2.

Depending upon conditions of heat flow and distribution, various methods of temperature determination may be used. No method is accurate, unless all the conditions of heat flow are accurately known, which is never the case in commercial machines.

The difficulties in the problem of commercial temperature determination are illustrated by Fig. 3.

In the figure, a represents the temperature inside an armature coil, b the temperature between the insulation and the iron of an armature tooth, c that in the body of the tooth, and d that in the body of the core at some point back of the coils and teeth. Let the temperatures at no load be represented on the ordinate A. Then, at some load, represented by ordinate B, the relations of the various temperatures have changed. At C, D and E, there are still greater changes, depending upon the heat generation and distribution. If the rated capacity of the machine is at E, for instance, then the armature copper is hotter than the iron, while if rated at B, the reverse would be true. Obviously, no rule can be formulated to cover these various conditions in different machines, nor even in a given machine, unless all the heat generation, distribution, and dissipation characteristics are known. Obviously, as far as the insulation is concerned, the temperatures of a and b are the only ones which need be considered.

All temperature determinations of a commercial nature, are necessarily approximations, or relative indications, upon which proper margins must be allowed for the ultimate temperature possibly attained. Therefore, in apparatus where there are liable to be discrepancies of 10 deg. between the measurable and the actual ultimate temperatures, a limit of 90 deg. cent. should be allowed by conventional temperature measurement on insulations in which 100 deg. is set as the maximum temperature with a reasonable length of life.

The conventional methods of temperature measurement, as by resistance, and by thermometer, do not usually give the maximum temperature, but give either the average, or the outside surface, values, and, when measuring the temperature by these methods, which are the only ones generally applicable, an allowance must be made in windings for possible local higher temperatures. These methods apply especially to those machines of moderate or low voltages in which the insulation is relatively thin, so that the heat gradient from the inside copper to the outside surface is small. Also, they apply particularly to those machines in which the conditions of ventilation are not normally difficult, and in which a fairly thorough distribution and dissipation of heat occurs among the various parts, such as in ordinary direct-current armatures, induction motors primaries, stators and rotors of moderate speed alternators in which the width is relatively small compared with the diameter, etc.

As the ultimate temperatures obtained by the apparatus depend upon its rise above the room temperature, or that of the cooling medium, and as such temperatures may vary over a wide range, it is not practicable to specify or guarantee ultimate temperature of apparatus without also specifying the elements upon which it depends. This, therefore, results in specifying the temperature rise in relation to that of the cooling medium.

While most apparatus operates at materially lower cooling temperature than 35 deg. cent. to 40 deg. cent., yet such temperatures are sometimes reached for considerable periods of time in steam stations, and it appears therefore as justifiable to choose the permissible temperature rise, such that, at room temperature of 35 deg. cent. to 40 deg. cent., an ultimate temperature of 85 deg. cent. to 90 deg. cent. by conventional methods of measurement, is not exceeded. This means, therefore, a temperature rise of 50 deg. cent. with conventional methods of testing, such as by increase of resistance, or by thermometer, in those insulations which can stand a continuous ultimate temperature of 100 deg. cent with a comparatively long life. This allows an excess of 10 deg. cent. to 15 deg. cent. for local spots, or for the temperature gradient through the insulation. A less allowance should be made for this difference when methods of temperature measurement other than the conventional are used, and which approach more closely to the highest temperature actually attained.

When the above temperatures are liable to be materially exceeded for long periods, heat-resisting insulation of class B is recommended. With such materials, a temperature of 125 deg. cent. is comparable with 85 deg. cent. to 90 deg. cent. in the materials of class A. Therefore, on this basis of a room temperature at 40 deg. cent. or 45 deg. cent., rises of 85 deg. cent. or 80 deg. cent. should not be considered harmful. However, in those special cases where the conventional methods may not sufficiently approximate local high temperatures, as may be the case in large turbo-generators, or in wide core alternators of large capacity, the rises of 80 deg. cent. or 85 deg. cent. should not be specified by resistance or thermometer, but preferably some lower temperature such as 50 deg. cent., thus allowing a very considerable margin for local higher temperatures. In such apparatus with the righer temperatures, which requires class B insulation, there is liable to be less uniformity of heat distribution.

If special methods of temperature measurement, such as exploring coils or thermo-couples are used in such apparatus, the temperature limit of 125 deg. cent. should be considered, and not the conventional 50 deg. cent. rise. In those machines of this class which have relatively thick insulation, and consequently may have a high heat gradient between the copper and the iron, (depending upon how much heat is flowing from the copper to the iron) an ultimate temperature of the inside insulation of 150 deg. cent. is considered as the limit, this being comparable with 100 deg. cent. with insulations of class A.

In certain classes of apparatus which are artificially cooled by air from outside the room, the cooling is accomplished partly by dissipating heat to the artificial air supply, and partly by dissipation into the surrounding room. If the temperatures of the cooling air and of the room are widely different, the resultant of the two temperatures should really be taken as that of the cooling medium.

The variation of the temperature rise has heretofore been considered as having a definite relation to the temperature of the cooling medium. However, it appears that it does not follow any definite simple law, but it is sometimes positive and sometimes negative, so that no satisfactory correction for room temperature is possible at present. It is therefore desirable to make the temperature tests at a room temperature as nearly as possible to some specified reference temperature. so as to make any temperature correction negligible. The reference temperature in the guarantees should therefore be such as can easily be secured; that is, it should be the average temperature of the places at which the apparatus may be operated. This is from 20 deg. cent. to 25 deg. cent., and as it is easier to raise than to lower the room temperature, the upper figure is advisable as a reference value. This reference temperature therefore should be chosen as 25 deg. cent., which is in accordance with the previous A. I. E. E. standard.

Measurement of Temperature

In the conventional methods of temperature measurement, by thermometer, and by resistance, many conditions should be taken into account, and good judgment is required, in all cases, or fallacious conclusions may be obtained.

There are many conditions which affect both the accuracy of the resistance and the thermometer methods of measuring temperature. The resistance method measures only the average temperature rise, and not that of local hot spots. However, it measures the internal temperature of windings, and therefore no correction is required for the temperature gradient through the outside insulation. The proposed margin between the result by the conventional method, and the actual temperature can therefore be allowed, in the resistance measurement, as the difference between the warmer and the average temperatures in the windings. In the resistance method of measurements, the rate of transfer of heat from one part of the winding to another will not greatly affect the result, as the measurement indicates an average temperature, which is that obtained if the heat were equalized throughout the winding. However, the rate of flow of heat from the windings through the outer insulation to other parts, will affect the temperature measurement by resistance, and preferably the measurement by this method should be taken during operation in those parts where this is practicable, as in field coils, and some other instances. In those parts where the resistance cannot be measured during operation, this should be done as quickly as possible after shut-down, and the time taken to shut down the apparatus should not be unduly long. Preferably, during shut-down of rotating apparatus the normal current should be maintained on the apparatus until at least a relatively low speed is obtained. This would represent only an average condition, as the ventilation at lower speed is very greatly decreased, while the losses in the windings will remain normal, thus tending to give an increased temperature in the windings. It would be difficult to fix any definite rule which would give the exact temperature conditions during shut-down.

In the measurement of temperature by thermometer, considerable judgment is required. Wherever possible, the temperature should be taken during operation, but the thermometer with its pad should be so placed that it does not interfere with the normal air circulation. In thermometer readings, as usually obtained on windings, the heat gradient through the insulation must usually be allowed for, this being 10 deg. to 15 deg. as previously defined. However, depending upon the method of taking the temperatures, this allowance should vary over a considerable range, depending upon whether or not the method of measurement approximates the actual internal temperature. For instance, the total heat gradient from the inside copper to the outside air will be that through the coil insulation, plus the thick covering pad over the temperature bulb. If the gradient through the covering pad is very large compared with that through the insulation, the thermometer may indicate almost exactly the internal temperature of the copper, that is, the heat gradient through the insulation to the themometer, may be relatively small compared with the total gradient to the air. This is particularly true where the thermometer rests on a metallic seat which covers a considerable portion of the coil surface. In this case, the heat which affects the thermometer bulb will pass through a relatively large section of surface, with a correspondingly small drop in temperature, so that the bulb more closely approximates the temperature of the inside copper.

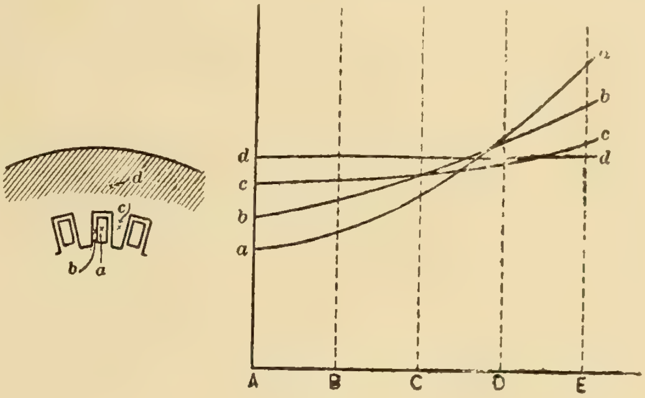


Fig. 3.

Where there is local heating in the windings, and a consequent liability of rapid transference of heat to other parts, the results obtained by the thermometer method will vary to some extent with the rapidity with which the actual measurement is made; that is, the more quickly the thermometer can be brought up to the full temperature, the more accurately the temperature of the hottest part is determined. With a very rapid method of measurement, it may be possible to measure practically the internal temperature of the copper of the winding before any great heat transference or dissipation has occurred. In such cases, obviously, the full allowance for the usual temperature margin should not hold. It should be fully understood that it is the ultimate temperature, and not the temperature rise, which should be considered as the limiting condition, and that the measured rise, plus the allowances for temperature gradient, plus the measured room temperature, is simply an indication of the possible ultimate temperature. By whatever method the temperature measurement is made, in all cases the results may be considered as more or less approximate, and in the end, it is the manufacturer who must supply the necessary margin over the approximate measurement, in order to make the machine safe.

A blind adherence to some particular rule or method of taking temperatures, may lead to fallacious results in some instances. In armature windings, in particular, incorrect readings may be obtained after shut-down. For example, if the armature iron back of the armature teeth were hotter than the armature teeth and coils during operation, then the temperature to which the insulation is subject during operation may be considerably lower than that in the hottest part of the machine, due to the ventilation conditions when running. However, upon shut-down, the temperature at the insulation may rise to that of the hottest part of the machine, and therefore a false temperature, by any method of measurement, might be indicated.

Recommendations

That with class A insulation, 90 deg. cent. be taken as the ultimate temperature limit, as indicated by conventional methods of measurement, or those which give similar results, and that 100 deg. cent. be considered as the maximum ultimate temperature permissible in the insulation, where a comparatively long life is a requirement.

That 40 deg. cent. be taken as the limiting temperature of the cooling medium, or room, and that, therefore, 50 deg. cent. be the permissible rise by conventional methods of measurement, with class A insulation.

That 25 deg. cent. be taken as the reference air temperature. With the permissible 50 deg. cent. rise, this gives 75 deg. cent. as the average operating condition, by conventional methods of measurement, or 85 deg. cent. actual temperature, when the usual margin represented by the temperature gradient is added.

An exception to the rise of 50 deg. cent. can be made in those cases where space or weight limitations are such that higher temperatures, with consequent reduced life, are commercially economical, such as in railway motors. In such cases, with class A insulation, a rise of 65 deg. cent. with reference air at 25 deg. cent. is at present accepted as good practice.

With class B insulations, 125 deg. cent. be taken as the ultimate temperature limit, as indicated by conventional methods of measurement, or by equivalent methods, and 150 deg. cent. be considered as the maximum ultimate temperature permissible in the insulation. It follows therefore that 80 deg. cent. to 85 deg. cent. rise is allowable, with such insulations, by the usual methods of measurement.

No temperature correction should be made for variation of the cooling temperatures from the reference temperature of 25 deg. cent.

When the method of temperature measurement shows the highest temperature actually obtained in the insulation, the maximum temperature specified for the given type of insulation should hold.

The Bell Telephone Company have purchased some property on St. Urbain street, Montreal, for the erection of a branch exchange, at a cost of $100,000. Plans are being prepared for this building which will not be erected until next year. It will serve parts of the division known as the "Main," "Uptown" and "East."

Telephone Developments

According to the statement of the Bell Telephone Company of Canada for the year 1912, submitted at the annual meeting in Montreal, the gross earnings totalled $7,638,304, an increase of $1,161,456; the operating expenses were $2,647,862; maintenance $1,403,339; depreciation $1,535,000; taxes $171,917. The net earnings were $1,880,185, an increase of $222,370. The balance after bond interest totalled $1,598,095 as against $1,425,835, and the surplus, after payment of dividends, was $449,133, as compared with $425,835. From this surplus $5,335 was charged off patent account, and $100,000 added to employees' benefit fund, leaving a balance of $343,774 to be carried forward. The balance on surplus account was $429,189.

Over 31,000 names were added to the list of subscribers during the year. At the close of 1912 it had in operation a total of 192,748 telephones, operated through 456 exchanges; it owned and operated 64,321 miles of long distance wire on 9,136 poles, and 2,784 miles of wire in underground and submarine cables.

Telephone Despatching

The Grand Trunk Railway Company have now completed the telephone system of train despatching between Montreal and Belleville. Between Montreal and Toronto there remain some forty miles of line to be strung, but between Toronto and Sarnia the line is practically complete. Mr. P. Hinton, general passenger agent for the Grand Trunk Pacific, reports that operation of trains by telephone is now in force on all the branch lines west of Edmonton. The experiments made have been successful and the system is in permanent use. On the Lake Superior branch the latest and most modern telephone apparatus has been in use for some time past, and similar equipment will shortly replace that now in use on the main line west of Edmonton.

Telephones in Elevators

Use of the telephone is constantly becoming more extended. A recent installation of considerable interest was that made by the Western Electric Company in the Woolworth Building, New York. That structure is fifty-five storeys high, and its fifteen elevators are each equipped with a telephone set and a loud talking receiver. These are connected with a main switchboard, operated by the elevator starter, on which the position of every elevator is constantly shown. The starter can switch his telephone in on any floor and get any one of his men to stop or start at any time. There is also a connection with the engine room by which the starter, in case of accident to engines or to elevators, can immediately be notified.

Can Erect Poles

By an order of the Railway Commissioners the Bell Telephone Company is to be allowed to erect poles on 23 streets in Montreal. The case for the company was that the cost of serving customers by conduits was prohibitive, and that objection was made to the erection of poles on private property. The Electrical Commission submitted plans showing that the problem might be solved by the building of manholes three hundred feet apart and from there using the trees on the streets in question from which to drop the wires for the supply of the customers. Objection was taken to this, and the Chairman, while allowing the use of poles on 23 streets, asked for information regarding other thoroughfares.

ELECTRIC RAILWAYS

New Barns of London & Lake Erie Railway Company

The London & Lake Erie Railway Company recently completed the construction of their new car barns which will accommodate their complete passenger rolling stock of sixteen 55-foot cars. This line operates between London and Port Stanley with 22 miles of line passing through St. Thomas, some nine miles south of London, and at this point the new car barn is situated. The line is operated since the new year by power supplied by the Hydro-electric Power Commission of Ontario, which is stepped down through 13,000/380 volt transformers. Motor-generators, the motors of which operate at 380 volts, supply current to the street railway system at 650 volts d.c.

The main car-barn is 210 ft. x 95 ft. and the whole of the company's passenger rolling stock, viz., sixteen 55-foot cars, can be accommodated. This building has two pits, one the whole length of the building and the other half the length, which enable easy inspection of the cars. To the east of the main building and under the same roof are the master mechanic's office, a large store room in which car repairs are kept, an armature winding room, a well-equipped blacksmith shop, carpenter shop and general repair shop. Near the general repair shop is a wheel pit running at right angles to the inspection pits which allows the easy removal of wheels from the cars. The main barn is fitted with an overhead travelling crane.

On the west side of the main building are a well-equipped lamp room and motormen and conductors' waiting room, fitted with lockers. The boiler room is in the basement and contains a 40 h.p. boiler for heating purposes. Other rooms include a linemen's room, a sand drying room with a hopper in which a car load of sand can be dried at one time, and a coal room. A special room is also supplied for washing the cars.

Just outside the car shed is a second building which houses the sub-station equipment and includes also a large freight shed, freight offices, ticket offices and waiting room. The freight shed has over 1500 feet of floor space.

Growth of Calgary System

On July 5, 1909, with a population of approximately 35,000, the city of Calgary first placed its municipal railway system in operation. At that date there were two cars in operation. The phenomenal growth of this city is shown by the following statistics: Cars operated on July 5, 1909, 2; July 1, 1910, 15; July 1, 1911, 22; July 1, 1912, 48. The number of miles of track on corresponding dates were 3, 16½, 26½, 54. The number of employees, 15, 62, 102, 246. In 1910 the revenue was $213,807; in 1911, $368,869, and in 1912, $606,083. During the present year seventeen miles of track will be constructed with additional car barn equipment. Also a number of cars will be added to rolling stock which will bring the total at the end of 1913 to 78 cars. The population at the present time is placed at 75,000. Mr. Thos. H. McCauley is superintendent of the Calgary street railway system.

New Cars for Regina

The Regina street railway system have just added to their present rolling stock eight double truck street cars built according to the following specifications by the Preston Car & Coach Company: Length of car body, 28 ft.; length of front vestibule (outside), 5 ft.; length of rear vestibule (outside), 7 ft.; projection of bunters, 6 in.; length of car over bunters, 41 ft.; width of car over side sheathing, 8 ft. 6 in.; width of car inside, 7 ft. 8 in.; height of car from bottom of sill to top of roof, 8 ft. 9 in.; width of front vestibule door, 30 in.; width of rear vestibule door, 48 in.; seating capacity, 38 people; cross seats and rear end longitudinal seats. Trucks, Brill 27-G.1., wheel base 4 ft. 6 in.

Electric equipment.—Four 40 h.p. 101-B. Westinghouse equipments; four 40 h.p. G.E.-80a Canadian General equipments, with K-28 controllers. Westinghouse S.M.1 straight air brakes.

Berlin and Waterloo Additions

The Berlin & Waterloo street railway system recently added two Preston cars to their rolling stock. The specifications of the cars are as follows: bodies 30 ft. 10 in.; front vestibule 5 ft.; rear vestibule 7 ft.; no bulk heads in either end, arranged for pay-as-you-enter; longitudinal seats with an extension running out into each vestibule which can be folded up when not required; cars are finished in cherry, both inside and out, natural finish; upholstered in rattan; mounted on Brill 27-G.E.-I trucks equipped with Westinghouse 101-B-2 motors; quadruple equipment; single end control; P. C. & C. Co.'s "Positive" sanders; electric bell circuit; celluloid sanitary hand straps; polished bronze trimmings. One of the cars is illustrated herewith.

Ottawa Car Co's New Manager

In a recent issue of the Electrical News it was announced that Mr. W. K. Jeffrey, who has been acting manager of the Ottawa Car Company for some time, was recently appointed manager. Mr. Jeffrey has only been with the Ottawa Car Company for eight years, starting in a very minor position, and his rapid promotion indicates at the same time his business ability and his appreciation by his company. Mr. Jeffrey was born in Kinburn, Ont.

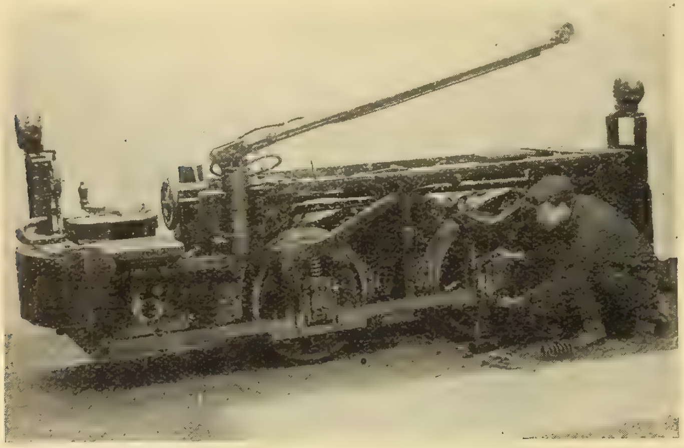
Mr. W. K. Jeffrey

New Type of Mine Locomotive

The accompanying illustration shows a new type of mine locomotive which has recently been placed on the market by the Baldwin Locomotive Works and the Westinghouse Electric & Manufacturing Company. The notable features are the open, cast-steel bar frame and the specially designed commutating pole mine motors. This type of locomotive is distinguished for its accessibility, simplicity, durability and strength. It is claimed that it will operate satisfactorily under the worst conditions with minimum attention and maintenance expense. The frame is designed to give maximum strength and to allow ready access to all parts so that the locomotive can be inspected and overhauled, when necessary, in the least possible time. The construction is the same as that used on heavy Baldwin steam freight engines.

The open frame gives much better ventilation to the motors and resistance than that obtained by armor-plate frame construction. The motors, brake rigging, brake shoes and sand boxes are easily accessible. The upper parts of the motors and armature bearing housings can be removed without disturbing the suspension, so that each part of the motor is exposed for inspection. To remove the grid resistors the only work necessary is to take off the locomotive covers and loosen the bolts and terminals that hold the resistor frames in place.

An attractive feature introduced on locomotives with outside frames is the Vauclain removable gib. To remove a journal box with this gib, it is only necessary to drop the binder and take the weight off the journal box. The journal box may then be slipped out from the side. On locomotives with inside frames, the journal box cellars are arranged to be easily dropped out for re-packing. If it is desired to take out a set of wheels and axle, this may be done without disturbing the motor suspension or connections by simply blocking the motors in place and removing the binders. The wheels may then be dropped.



New type Westinghouse mine locomotive

The motors used in this locomotive have decided advantages over other types, of which their excellent commutation, due to the use of commutating poles, is of first importance because it increases reliability of operation and cuts down the cost of maintenance. With good commutation, the commutator and brushes require very little attention and brush renewals are seldom necessary. The insulation of armature and field coils remains in good condition for a much longer time than on other types because of the absence of copper and carbon dust.

The frames of the motors are made of cast steel and are split diagonally. The axle bearings and suspension nose are on the lower half of the frame, so that the upper half, the armature, and bearing housings can be removed without disturbing the suspension of axle brackets. The armature and axle bearings are of bronze and are oil-and-waste lubricated. The armature coils are form wound and are made moisture-proof by means of an impregnating compound. The field coils are impregnated and protected from vibration by heavy cushion springs placed between them and the motor frame. The armature core is mounted on a spider to which it is keyed, making it possible to remove the shaft without disturbing the windings, and also reinforcing the shaft against bending. Large openings are provided in the spider and through the core to give sufficient ventilation.

Track Paving Costs

A paper was recently read before the Canadian Society of Civil Engineers by Mr. Frank Chappell, town engineer of Oshawa, on the subject of street and railway track paving with asphalt block in a suburban town. Mr. Chappell gave some interesting figures regarding the cost of this work, which we reproduce herewith.

Price of gravel, deposited on work by teams at contract price	$1.00 cu. yd.
Price of cement deposited in shacks	1.52 barrel
Superficial Prices:—	
Excavation and grading	.17 sq. yd.
Concrete base (5")	.53 sq. yd.
Blocklaying and ½" cushion	.22 sq. yd.
Blocks—teamed on to the work (freight Windsor to Oshawa inclusive)	1.57 sq. yd.
Cubic Yard Prices for Work Under Track:—	
Excavation	.50 cu. yd.
Concrete base	4.68 cu. yd.
Curb and gutter	.56 per lin. ft.
Average cost of catch basins	24.00 each
Total cost per lineal foot of 40 ft. road	14.84
Total cost per lineal foot of 35 ft. road	12.98
Total cost per lineal foot of 30 ft. road	11.12

These measurements are taken from face to face of curb.

This table of total costs includes paving the street, laying curb and gutter, paving the track allowance, extra concrete under the ties, the dismantling and relaying of the track, age of the pavement was 14,300 sq. yds., and the total cost together with all catch-basins, etc., required. The total yard-including the foregoing incidentals was $47,750.00.

Electrification of Melbourne Suburban System

Announcement has just been made that a contract for the electrical equipment for the electrification of the suburban railways around Melbourne, Australia, has been awarded to the General Electric Company, Schenectady. The mileage of the system to be electrified is approximately 300 miles. Power will be supplied from a central station in one of Melbourne's suburbs, and will be three-phase, 25 cycles. This will be transmitted at 20,000 volts to 12 sub-stations placed at various points on the system and where it will be converted into direct current at 1500 volts. The General Electric contract includes 400 motor car equipments consisting of four motors each and 800 control equipments, 400 being for trailer cars. Each car will carry four motors rated at 140 h.p. each at 725 volts. The motors will be operated two in series from the 1500 volt feed lines.

Montreal Tramway Problems

The affairs of the Montreal Tramways Company have again been before the public during the last two weeks, and many suggestions for the solution of the tramways problem have been put forward. One is that the city council and the company should get together in order to devise a means of breaking the present deadlock. The council are making inquiries as to whether the company have lived up to their contract with the city. Controller Dupuis is in favor of building subways, as he believes it is the only way of effectively dealing with the traffic problem. The Tramways Company are negotiating with the city of Westmount for a fast service, and to carry out the scheme two or three pieces of new track will have to be laid. It is hoped to avoid the present congested lines and to save several minutes by the new route.

Appointed Signal Engineer

Mr. R. F. Morkhill, electrical engineer, has been appointed signalling engineer of the Grand Trunk, with office at Montreal, in succession to Mr. C. A. Dunham, who has resigned. A little more than six years ago he was in charge of the signalling on the Central South Africa Railway after the war, organizing the signalling system on that road. He was then employed in the head sales office at New York of the Union Switch & Signal Company, and was later one of the assistant engineers in the construction of the Pennsylvania's New York terminals. Later Mr. Morkhill joined the Railway Signal Company of Canada, Limited, which was then being organized, as sales manager. Last August he was made assistant general manager of this company.

Report on Tramways Congestion

Mr. John P. Fox, who has been engaged by one of the Montreal papers to inquire into the local tramways situation, has made a preliminary report dealing with the overcrowding, with a view to remedying the congestion which takes place at the rush hours. His report may be summarized by the following suggestions, which he believes, if adopted, will immediately lessen the present over-crowding:

1. Abolition of the cross-seats, which prevent the even distribution of passengers through the whole body of a car. This will not lessen the seating capacity and will relieve the back-platform crowding.

2. Removal of the heavy partitions between the rear platform and the body of the car.

3. Installation of sliding or folding doors at the steps of all cars to protect the dangerous overcrowding of the rear platform. This expedient has been adopted in many United States cities with marked success.

4. Operation of every car available for service; this includes the transforming of the old open cars into a closed type, which can be used to relieve the situation until modern cars can be obtained elsewhere. Single-truck cars are bad, but they should not be scrapped until enough new cars are available to greatly reduce the present overcrowding.

5. Single-truck cars should be operated in pairs, or connected together by an enclosed centre-platform, after the Boston model.

6. The company should make every effort to reduce delays in the actual operation of its car schedule.

7. There is, as yet, no convincing evidence that more streets are needed to make a satisfactory service possible. The cars operated in Montreal during rush-hours do not approach the number operated in other cities.

8. The double-tracking of St. James street and of Notre Dame street is feasible and would greatly relieve the congestion on Craig street, as well as facilitating the handling of rush-hour crowds.

9. A reserve of cars should be stored near the centre of the city for rush-hour needs.

10. A new type of double-truck car is urgently needed here. The latest Montreal cars have only forty seats, while a far lighter type used in Pittsburgh has 67. Double-deck cars, with seating capacities of from 90 to 100 passengers, could be operated without difficulty on most of the important lines here.

Mr. Fox's report was submitted to Messrs. Huntly Drummond, president of the Board of Trade; Chas. Chaput, president of the Citizens' Association; Col. Labelle, president of the Chambre de Commerce; Henry Miles, president of the Montreal Business Men's League; and Mr. Foster, president of the Trades and Labor Council. At a later date Mr. Fox will submit another report dealing with various other points in the tramways situation.

Educating the Public

The Chicago City Railway Company, who have recently inaugurated a number of "nearside " cars, are educating the public in the correct use of these cars by full page advertisements in the local papers. The picture of entrance-exit of the car takes up practically the whole page, leaving only enough space for the following explanations: "The Chicago City Railway Company stands for improving service. The management of this company is directing its efforts towards the best methods of securing maximum convenience and comfort of passengers, increased welfare and efficiency of employees, and reduction of accidents to a minimum. Your co-operation is necessary. The Nearside car is the safe way.

Personal

Mr. H. A. Brazier has been appointed assistant city engineer of London, Ont.

Mr. M. H. Baker, city engineer of St. Thomas, has been appointed city engineer of Prince Albert, Sask.

Mr. W. N. Ashplant has been appointed city engineer of London, Ont.

Mr. D. H. McDougall has been appointed assistant general manager of the Toronto Electric Light Company.

Mr. R. E. T. Pringle has moved his headquarters from Windsor, Ont., to 308-9 Tyrrell Building, 95 King street west, Toronto.

Mr. F. L. Hubbard has been appointed assistant to the general manager of the Toronto Railway Company. Mr. Hubbard is a son of Ald. W. P. Hubbard, of Toronto.

Mr. A. J. Soper has been appointed district sales manager for Ontario for the Northern Electric & Manufacturing Company, with headquarters in Toronto.

Mr. W. H. Tees has resigned as chief electrician of the Canadian Consolidated Rubber Company, Montreal, and is now Assistant Superintendent of the Sayer Electric Company, Montreal.

Mr. Wm. G. Merowitz has severed his connection with the Holtzer-Cabot Electric Company, of Boston, Mass., and is now engaged as a power apparatus sales specialist in the supply sales department of the Northern Electric & Manufacturing Company, Montreal.

Edmonton Telephone Plans

The city of Edmonton will spend in the neighborhood of $1,000,000 on extension work during 1913, the greater part of which will be cable work. It is the intention of this municipal department to build a lot of underground conduit both in South Edmonton and North Edmonton, and there will also be considerable underground cable work and aerial cable work. Very little open wire construction is used except in very sparsely settled districts. Last year this department built two new branch exchanges giving them four exchanges in all at the present time. Mr. W. R. Griffith is superintendent of Edmonton's telephone department.

The plans of the Humber Valley Electric Railway have been approved by the Ontario Railway and Municipal Board. This railway will parallel the old Belt Line from the lake shore to Bloor street.

Illumination

Proper Lamp Voltages

An incandescent lamp consumes its rated wattage, gives its rated candle-power, and lives its rated life only when supplied with current at a voltage equal to the rated voltage of the lamp. If the voltage supplied to the lamp is less than the rated lamp voltage, the candle-power and the wattage consumption are decreased and the life is lengthened. If the circuit voltage supplied is greater than the rated lamp voltage, the candle-power and wattage consumption are increased and the life is shortened.

In any electric supply system the voltage supplied may not be the same at various parts of the system at any one given time, and it may not be the same at one location at different times of the day, or, in other words, the voltage may be said to vary with the distance of transmission and with the time of day. As the voltage varies, the connected lamps will undergo variations of candle-power, wattage consumption, efficiency and rate of destruction (consumption of inherent life). When a lamp is chosen for use on a circuit, it is usually selected because it is known that at some certain voltage the lamp will give a certain candle-power, consume a certain wattage, have a certain efficiency, or give a certain life. If the voltage of the circuit does not stay approximately constant at the predetermined value the above criteria of selection cannot be applied. The best that can be done is to select the lamp with respect to the line voltage and its variations so that the average candle-power values given at all times would be the same as if the lamp were burned continuously at its rated voltage; similarly, the wattage consumption or the efficiency might be adjusted for correct average values, or the lamp voltage could be so chosen that the life of the lamp would be the same as when burned continuously at rated voltage. Of the above mentioned factors—candle-power, wattage, efficiency and life—the last will be found to vary more with change of voltage than any of the others. Hence, if a lamp is so selected that a proper life is obtained, approximately correct values of the candle-power, wattage and efficiency will also be obtained.

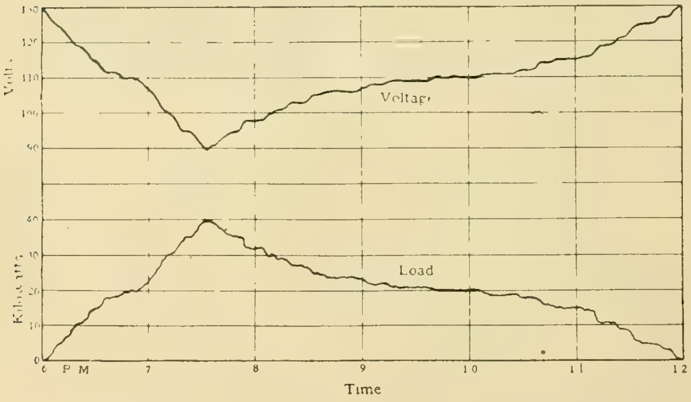


Fig. 1

It is but natural to make the assumption that the average voltage of a circuit during lighting hours is the proper voltage rating for the lamps to be used thereon. If a lamp is burned half of the time at a given percentage below its normal rated voltage and half of the time at the same percentage above this normal value, it will be found that its life is decreased. The magnitude of the decrease will depend upon the difference between the burning voltages and the rated voltage. The reason for this is that in a given period of burning at over-voltage, more of the inherent life of the lamp is consumed than is recovered when burning for an equal length of time at a corresponding amount under-voltage—the net effect being to obtain a shorter life than when burned continuously at rated voltage.

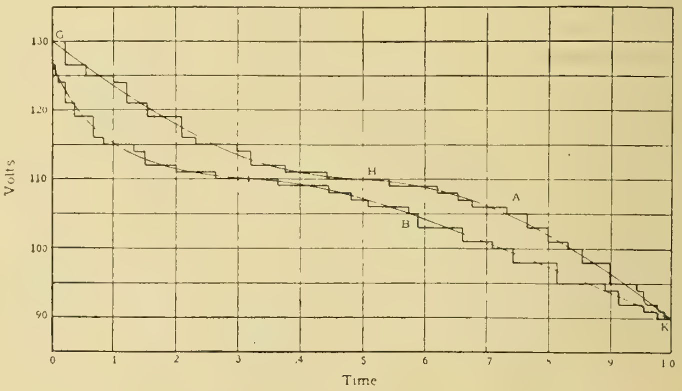


Fig. 2

It is evident, therefore, that if during lighting hours the voltage of a circuit fluctuates above and below an average value, the theoretical proper lamp voltage is slightly higher than this average voltage; and the greater the fluctuations, the greater should be the difference between average voltage and lamp voltage. This theoretically proper lamp voltage might be called the "effective voltage" of the circuit, since it is the voltage which is effective in selecting lamps. Since the effective voltage is determined by the effect of voltage upon lamp life, it will depend upon the class of lamp considered, i.e., will not be the same for Mazda lamps as it is for Carbon, etc.

Mathematical analysis shows that it is only on circuits which have excessive voltage fluctuations (such as heavily loaded combination power and lighting circuits, railway circuits, etc.) that this difference will amount to enough to warrant serious consideration. As a general rule it may be stated that the difference between the scientifically correct lamp voltage and the average line voltage during lighting hours will not amount to even one volt unless the circuit voltage fluctuates more than 6 per cent. above and below this average value.

In general a customer of a central station or an isolated plant, in selecting lamps to be used on circuits of fluctuating voltage, is concerned only with the variations of voltage with time. The management of the central station, however, in selecting lamps for use on the whole system, is confronted with a more complicated problem, since in this case the variations of line voltage both with time and with distance should be considered.

In cases where very great variations of voltage with distance are encountered, it is not uncommon practice to use different voltages of lamps for different districts. The advisability of such a procedure is more often a question of policy than of theoretical necessity, hence it will be assumed in illustration that only one voltage of lamp is to be used throughout the system and methods will be discussed whereby the proper lamp voltage may be determined.

An accurate theoretical determination of the proper lamp voltage would require that throughout a day voltage readings be taken at intervals of a few minutes on the premises of all the customers of the stations, and that such a proceeding be repeated several times during a year in order to take account of the seasonal variations of load. An investigation of so great a magnitude would manifestly be out of the question, hence approximations may be introduced to shorten the work. The first approximation would doubtless be to lessen the number of locations at which voltage readings are to be taken. Readings at the centre of the load, or so-called "centre of gravity" of each feeder or small district will be sufficient for the feeder, since the low voltage beyond the centre will compensate for the high voltage between the centre and the station.

The data which should be taken for each feeder or district are simultaneous readings of the voltage at the centre and of the total load on the feeder. If the investigation is limited to the taking and averaging of voltage readings only, and no attention is paid to load, erroneous conclusions may be drawn. On the majority of electric supply systems a large part of the voltage fluctuation is due to load variations, the voltage being high during periods of light load and low during periods of peak load. For this reason, the low voltage readings should be given greater weight than the high voltage readings. It is evident that a straight arithmetical averaging of all voltage readings would give a final average voltage higher than an average in which the readings were all weighted in proportion to the number of lamps on circuit (total load on feeder, if load is all lighting) at the time of the reading.

TABLE 1.

Line Voltage	No. of Readings	Sum of Loads at each voltage	Line Voltage	No. of Readings	Sum of Loads at each voltage
90	1	40	109	7	147
91	1	39	110	9	180
92	2	76	111	6	114
94	1	36	112	5	90
95	4	140	114	2	32
98	4	128	115	6	90
100	2	60	116	2	28
101	3	87	119	5	65
103	3	81	121	3	27
105	3	75	124	2	12
106	5	120	125	4	20
107	2	46	127	3	9
108	3	66	130	2	0
			Total	90	1798

The following is given as an example of the correct method of working out the average voltage for a lighting circuit. In order to illustrate clearly the principles involved, a circuit of excessively bad voltage regulation was assumed on which the station voltage is maintained at 130 volts and on which the line drop from the station to the "centre of gravity" of the load is approximately one volt per kilowatt of load. Fig. 1 shows the assumed load and voltage curves. If these readings are tabulated according to voltage, the results would be as shown by Table I. The first column is the number of readings at which each voltage prevailed on the line. The third column is the sum of the load readings (kilowatts) corresponding to each of the voltages. Fig. 2 shows the tabulated data plotted in curve form. Curve A is plotted directly from the voltage readings alone. The length of each horizontal step shows the comparative length of time (number of readings) during which each particular voltage prevailed on the line, hence we will call this style of graph a "duration curve." The arithmetical average of this curve is 110 volts, and the effective value or proper lamp voltage (for Mazda lamps) is 114.9 volts. The weighted curve, B, is plotted by making the length of each horizontal step proportional to the total kilowatts of load corresponding to each voltage, rather than proportional to the number of readings at each voltage. The effective value, or proper lamp voltage, for this "duration curve" is 111.3 volts. It is thus seen that a considerably different result is obtained when all the voltage readings are properly weighted with respect to the number of lamps on circuit at the time.

If the voltage readings had been obtained from a street-railway circuit on which a constant number of lamps is used, the effective value of Curve A would give the proper lamp voltage directly.

De Luxe Set for the Home

The Tungstolier Company of Canada claim to have been the first fixture manufacturers on this continent to offer a complete set of fixtures for a home. This method of selling fixtures should appeal greatly to the dealer as he is in a position to show the customer just what he can offer and at the same time he can know the absolute cost of the complete outfit. This company are now getting out additional sets of fixtures for residential use under the name of De Luxe set.

Typical Unit of De Luxe Set

A cut of the first set appears in the advertising pages of this issue of the Electrical News. The De Luxe set is one of the most attractive propositions ever sold by the Tungstolier Company. The fixtures are well made and handsomely finished. Another feature embodied in these sets is the method of packing always followed by this company, namely, a complete set in one box.

The Dealer and Contractor

Why Electrical Contractors Fail

Statistics show that during the last twenty years sixty-five per cent. of electrical contracting firms have ended in disaster and the cause of this unfortunate condition should, if possible, be discovered and remedied. It is probable that these contractors failed to appreciate the heavy cost of running their business and in making estimates, omitted to make a proper allowance for overhead expenses. This seems all the more likely in view of figures recently compiled by the Electrical Contractors' Association of Illinois, which show that in the smaller concerns overhead charges may easily amount to well up to 50 per cent. of the business done. Some actual examples were given, as a $10,000 business being found to cost forty per cent. in overhead expenses; a $20,000 business 28 per cent.; a $30,000 business 23 per cent.; a $100,000 business 17 per cent. This evidently is harder on the small contractor, and so it is all the more necessary why he should studiously consider this element in his expenses.

There is also the other important consideration that the large majority of electrical contractors have risen from the ranks of the wiremen, and so lack the business education and experience necessary to compute, accurately, the cost of carrying on their business. As a result the work is carried on in more or less of a haphazard, guess-work way which very soon also shows itself in the methods of the employees with the final results already noted.

Profiting by the experience of others, the more successful contractors have seen the necessity of carrying on their business in a systematic manner, making careful note of all expenses and watching the results of every individual piece of work to see where any little losses may have crept in that were unexpected, or any little profits that may have shown themselves which were worth developing. As an example of the plan followed by one successful contractor whose work is chiefly in private residences and the smaller factories, we reproduce herewith a miniature copy of an estimate sheet which he has gradually evolved through several years of experience of the requirements of his business. It will be noted that in the left-hand column of this sheet what may be called the requirements of knob and tube work are tabulated. On the right-hand side the blank portion increases the usefulness of the sheet by making it available for other classes of work such as conduit, or in factory wiring, where drop lights, glassware or lamps may be included in the specifications; or again, for keeping track of extras. In the lower right-hand corner there is a place for keeping tab on labor, and a space for the all-important overhead expense. A feature of great importance in this estimate form is the double column, as shown, in one of which his estimate of the quantity of material is placed. Against this (after the work is done) he puts in the other column the actual amount of material used. Under the heading of cost there are also two columns, the first dealing with the estimate, the second with the actual. This plan, followed out systematically, will show at a glance how close he has been able to estimate on any work of a certain kind, and if another piece of work which is quite similar to anything he has already done, comes along, he is then in a position to know the actual costs.

These forms, of course, are filed for reference, each being attached to the schedule or specification of the job or

Date....................................

Name.....................................

Address...................................

Material	Quantity		Cost				
	Estimated	Actu	Estimated	Actual		Estimated	Actual
Inspection....................							
Cartage							
Tape.....................							
Wire.....................							
14 Wire.....................							
Alphaduct.....................							
Knobs							
8 in. Tubes.....................							
5 in.							
Snap Switches S. P...........							
3 Way							
Flush Switches							
3 Way							
2 Pt.							
Receptacles					Total Material		
Knife Switches							
Cutouts					Labor		
Asbestos							
Standpipe							
....							
....							
....					Overhead Expenses..........		
Bells							
....							
....							
Total					Grand Total		

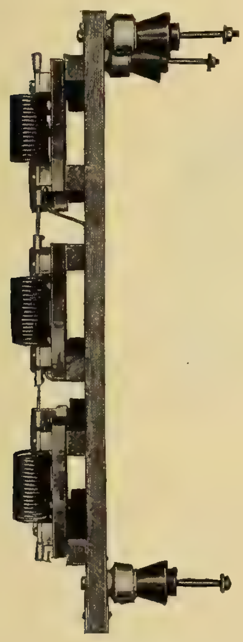
contract to which it refers, and the fact, as stated above, that this particular contractor has been successful where others in the same class have failed, is the best proof that a system of this kind is not only desirable, but is, other things being equal, essential, if the work of the electrical contractor is to be carried on on a fair and profitable basis.

The right price to charge for a job of electrical work is one that will leave a profit over and above all cost, including stock, labor, depreciation, advertising, spoilage, insurance, power, light, fuel, rent, taxes and the thousand and one other items of expense the contractor is called upon to pay. Guessing methods, second sight, mind reading, telepathy and similar methods will not give that cost. It requires a well-planned and operated cost system to do it; and the quicker a contractor installs that, the better he will succeed.

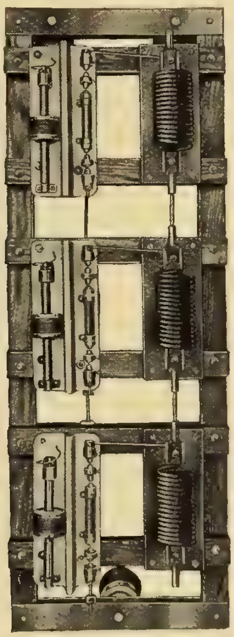
Panel Board Lightning Arresters

A great many railway, lighting, mine and industrial properties have certain "spots" where lightning conditions are particularly severe, and where it is difficult to secure thoroughly efficient and reliable lightning protection. In other cases, particularly central station and mining properties, there is certain electrical apparatus that needs what might be termed one hundred per cent. protection. For mining service, such apparatus might supply power to fans and pumps; or for central station and electric railway service, very important pieces of generating or transforming apparatus, on which much depends.

For the protection of these important installations, the Electric Service Supplies Company has placed on the market a line of panel board lightning arresters, for both d.c. and a.c. service. Illustrations of typical boards for both d.c. and a.c. service are shown herewith. These boards are built on the theory that no matter how efficient a lightning arrester may be, it will never carry off every bit of a lightning discharge from a given line. Some small portion will always find its way past an arrester, through any choke coil in back of the arrester and into the apparatus to be protected. With an efficient lightning arrester and a suitably designed choke coil, this leakage will be small, usually not enough to damage the apparatus. With very heavy induced strokes, and under certain other conditions, the leakage may become heavy enough to damage the apparatus. These panel board arresters are designed to effectually take care of this leakage by interposing additional choke coils between the line and the apparatus to be protected, and of connecting lightning arrester units ahead of these coils. Any leakage passing the first arrester unit, for instance, in a triple board, must pass through three choke coils and by two additional arrester units before it can get into the apparatus.



Side view 2500 v.
a.c. panel board



2500 volt a.c.
panel board

With but a single choke coil and a single arrester unit, and assuming that 9/10 of the discharge goes to ground through the arrester, it is seen that 1/10 will be left to enter the apparatus. If an additional choke coil and a second arrester unit be placed back of the first set, and assuming that the second unit takes 9/10 of the leakage 1/10 to ground, only 1/100 of the original charge remains to flow into the arrester unit, but 1/1000 of the original charge will be left to enter the apparatus to be protected. In other words, by apparatus. Similarly with a third choke coil and a third the addition of extra arrester units and extra choke coils, the protection to apparatus has been increased ten times by a double panel board, a hundred times by a triple panel board, and a thousand times by a quadruple board.

The boards are regularly furnished in station type, mounted on heavy impregnated oak framework and are furnished complete with insulators for attaching to any suitable supporting means. The arrester units are furnished with highly polished and lacquered metal work. Choke coils are of copper, black enamelled and baked. They are designed especially for the protection of apparatus up to 6600 volts a.c., up to 2500 volts d.c. railway, and up to 6000 volts d.c. or a.c. arc circuits, and are furnished in any ampere capacity for voltages within this range.

Use Your Show Windows

If you are located on the principal street you are paying an increased rent owing to the fact that you have an attractive display place for showing goods. Why not get the greatest possible advertising value out of this place?

If you contract for newspaper space you would not think of leaving it blank, so why leave your show windows in a condition where they do you no good when they can do more for you, possibly, than any other form of advertising, but a window that is allowed to become dirty, and never changed, is a detriment to your business.

If you intend to use your show windows, they should be decorated systematically and carefully. Windows should be kept absolutely clean, should be filled with fresh goods, and should be kept carefully dusted.

The display should be changed at least every two weeks, and placards used showing the price and uses of the articles shown. At different seasons the windows should be devoted to the special article that is in use at the particular time.

Moving displays can also be used to great advantage and at a comparatively small expense. A moving display in a window always attracts a crowd, and if properly placed and placarded should result in greatly increasing your sales. You will also find that manufacturers will be glad to supply you with window displays, and the necessary cards and advertising matter to go with it. An example of this is shown by the displays furnished by the lamp manufacturers, which have attracted attention all over the country. Supplies of this kind can be well handled by using them at a time when the manufacturer in question is using general publicity in the magazine. This will result in your securing the benefit of his general advertising, as well as your own show windows.

Think it over and see if you have given this chance of good advertising the proper consideration, and if not take it up the coming season and make your windows attractive and profitable to your business.—National Electric Contractor.

Table of Carrying Capacity of Wires

The following table, showing the allowable carrying capacity of copper wires and cables of ninety-eight per cent. conductivity, according to the standard adopted by the American Institute of Electrical Engineers, must be followed in placing interior conductors.

For insulated aluminium wires the safe carrying capacity is eighty-four per cent. of that given in the following tables for copper wire with the same kind of insulation.

B. & S.	Rubber Insulation Amperes	Other Insulations Amperes	Circular Mils
18	3	5	1,624
16	6	8	2,583
14	12	16	4,107
12	17	23	6,530
10	24	32	10,380
8	33	46	16,510
6	46	65	26,250
5	54	77	33,100
4	65	92	41,740
3	76	110	52,630
2	90	131	66,370
1	107	156	83,690
0	127	185	105,500
00	150	220	133,100
000	177	262	167,800
0000	210	312	211,600
	200	300	200,000
	270	400	300,000
	330	500	400,000
	390	590	500,000
	450	680	600,000
	500	760	700,000
	550	840	800,000
	600	920	900,000
	650	1,000	1,000,000
	690	1,080	1,100,000
	730	1,150	1,200,000
	770	1,220	1,300,000
	810	1,290	1,400,000
	850	1,360	1,500,000
	890	1,430	1,600,000
	930	1,490	1,700,000
	970	1,550	1,800,000
	1,010	1,610	1,900,000
	1,050	1,670	2,000,000

The lower limit is specified for rubber-covered wires to prevent gradual deterioration of the high insulations by the heat of the wires, but not from fear of igniting the insulation. The question of drop is not taken into consideration in the above tables.

The Simplex Wiring Computer

Electrical engineers and wiremen will be interested in the wiring computer which the Simplex Wire & Cable Company, of Boston, are distributing. The computer is mounted on stiff thick celluloid of a convenient pocket size and consists of a circular slide rule particularly adapted for wiring calculations. By a single setting of the computer the following results may be obtained:—the size B. & S. gauge of a wire is readily determined by setting the disc to correspond to a given distance of distribution for a desired voltage drop and the current which the wire is to carry; or given the size B. & S. gauge, the current to be carried, and the distance of transmission, the resulting voltage drop may be read directly upon the computer. In like manner, the current may be found at one setting for a desired voltage drop with a definite sized wire and distance of transmission. Finally the distance to correspond to specific conditions of voltage drop, current and size of wire may be found by a single setting of the disc. The setting of the disc is very simple and directions for attaining these four different results are given explicitly at the foot of the card and much laborious figuring is avoided by its use. On the reverse side of the pocket card are handy tables of wiring data and table of decimal equivalents of fractions of an inch.

Safety Cut-out Hanger

The Thompson Electric Company, Cleveland, have issued a folder giving ten reasons why the Thompson Automatic Safety Cut-out Hanger should be made a part of every lighting system. This cut-out device is one by which any lighting unit in a multiple circuit may be automatically cut out and lowered to the ground for cleaning, trimming or renewing. It is made in two sizes, one for enclosed and flaming arc lamps, the other for large tungsten units and clusters. It is particularly adapted for use in railway shops and sheds, mills, factories and industrial plants of all kinds. The accompanying illustration represents the small multiple type for use with tungsten units.

Engineering Works of Canada

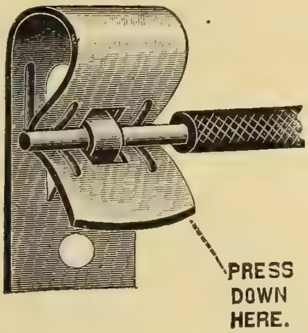
The Engineering Works of Canada, Montreal, have issued a catalogue describing their two and three phase induction motors. The following types are described: type N, an open type in capacity from ½ to 200 h.p., built with squirrel cage or slip-ring rotor; type NA, having a rotor with two special windings, and type NE, a special design of enclosed motor requiring only a slight increase in size over the open type. The type NA was designed for use where constant speed is required with a high starting torque and perhaps frequent starting of the motor. With the ordinary slip-ring type rotor a resistance has to be kept almost constantly in circuit involving a considerable loss of energy. This disadvantage has been overcome by providing the rotor with two windings, one of copper and one of iron. The motor is started on the iron winding which is of high resistance and after the motor reaches a pre-determined speed the copper winding is automatically cut into the circuit, the iron winding being cut out at the same instant. An important feature in the design of the NE type is the provision for two different circulations of air completely separated and independent from each other. The capacity of this enclosed motor is only 15 per cent. less than that of the same size open type. This company also have patented a very simple mechanism by means of which single phase induction motors can be started under load exactly as an ordinary polyphase induction motor without too high a starting current. This company make installations of complete rolling mill, hoist and mining machinery.

Lightning Arresters

Tht Electric Service Supplies Company, Philadelphia, Chicago and New York, have issued their 1913 edition of catalogue on Garton-Daniels lightning arresters and other lightning protective apparatus which is in reality a short treatise on Lightning Arresters. In this booklet is given much information relative to lightning phenomena, installation of lightning arresters, grounding, distribution, inspection and other allied subjects. Its catalog pages illustrate and describe the complete line of Garton-Daniels lightning arresters, a new line of panel board lightning arresters catalogued for the first time by this company, high voltage and low voltage choke coils and disconnecting switches, grounding apparatus, etc. The last eight pages are given over to installation diagrams, through which it is possible at a glance to not only learn the proper method for installing lightning arresters on any circuit, either d.c., a.c. or arc, but also to select exactly the type of arrester which is best suited for the protection of any class of circuit.

Spring Binding Post

The accompanying sketch illustrates the Fahnestock spring binding post manufactured by the Fahnestock Electric Company, of 129 Patchen avenue, Brooklyn, N.Y. This binding post has much to recommend it in that contacts are quickly made, the electrical contact is good, and suspicion of bad contact can be very easily tested. This type of binding post is being installed very largely on batteries of various kinds but is applicable to practically every kind of electric service.

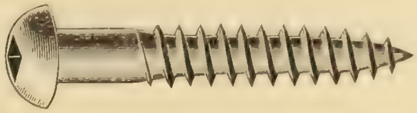


Imperial Wire & Cable Co.

The Imperial Wire & Cable Company, Limited, Montreal, are opening an office at Room 611 C. P. R. building, Toronto. Mr. A. J. Soper, formerly connected with the sales department in Montreal, has been appointed district sales manager for Ontario. The same company are also opening an office in Winnipeg, and have taken temporary quarters at 158 Portage avenue east, and later will move into the Electric Railway Chambers as soon as they are completed. Mr. W. F. Uhl, formerly in the sales department of the Northern Electric and Manufacturing Company, Winnipeg, has been appointed district sales manager for Manitoba, Saskatchewan, and Ontario, as far east as Fort William and Port Arthur.

A New Wood Screw

We illustrate herewith a new make of wood screw which we believe will fit the needs of the electrical contractor and save him much valuable time in making installations in difficult places, at the same time enabling him to perform this work efficiently. The screw has a square hole in the head into which a specially designed screw driver fits. In cramped places or for an insertion which is almost out of reach of the workman, this screw may be placed on the driver, reached out at arm's length and driven with one hand. Various types of drive are available and all kinds of wood screws covering the different phases of electrical installation work. This screw and driver is manufactured by the P. L. Robertson Manufacturing Company, of Milton, Ont., and attention is drawn to his advertisement appearing on another page of this issue.



Jovian Rejuvenations

The first rejuvenation of the Saskatoon Jovian Order was held at the King George Hotel on Saturday evening, February 22, when Mr. Edward Hanson, City Electrical Engineer of Saskatoon, was elected statesman of the local order. Twenty-eight members were initiated at this rejuvenation, which is claimed to be a record, taking into consideration the size of the city. Among those taking part in the rejuvenation were Mr. C. H. Abbott, Mr. J. G. Monahan, Mr. E. H. Smith, Mr. Raymond Wright, of Prince Albert, and Mr. W. H. Reynolds, who acted as chairman. It was stated at this banquet that the total number of members of the Jovian order in Canada is now approximately 9,000.

Notice has been sent out by Mr. E. B. Pike, Statesman for Ontario, of a rejuvenation to take place on Friday, April 4, 1913, in the large ball room and assembly hall of the Temple Building, Toronto. Mr. W. W. Lovell, chairman of the degree team committee, is already holding rehearsals. The letter states that application blanks for new members can be secured from Mr. S. C. Dewitt, chairman of the membership committee, 90 Sherbourne street, or from Mr. Pike at 220 King street west, and the personal co-operation and assistance of the members is requested in bringing in new members.

Regarding the Jovian luncheons which have been held weekly at the Prince George Hotel, it has been decided not to continue them under the present circumstances, due to fact that there was no privacy, and the weekly talks could not be indulged in. It is now proposed to charter a private dining room in the same hotel to accommodate about forty-five persons. It will be necessary, however, to guarantee this number of guests and it has been suggested that a small assessment be made on the members which shall form a sinking fund to take care of any possible deficit. The assessment suggested is only 25c a month, and the co-operation of all good Jovians is requested in sending in their remittances to Mr. J. Ward, treasurer, care Northern Electric & Manufacturing Company, Toronto.

Electric Vehicles at the Motor Show

As far as electrically driven automobiles are concerned, the recent motor show in Toronto could scarcely be considered a success. Only two firms of electric vehicle manufacturers exhibited, and there was a noticeable absence of electric trucks, a vehicle which is coming so prominently into use in the last year or two. The exhibit of the Peck Electric was especially worthy of notice. This car represents the latest refinements in automobile construction, and was the centre of admiration throughout the exhibition.

Exclusive Canadian Agents

The Northern Electric & Manufacturing Company, Limited, Montreal, have been appointed exclusive selling agents in Canada for the American Electric Heater Company of Detroit, who claim to be the largest exclusive manufacturers of electrical household appliances in America. It is the intention of the Northern Electric company to carry large and comprehensive stocks of this material at each of their distributing houses. This company have also been appointed exclusive agents for the Triangle Lektrik Sales Company of Detroit, manufacturers of the Triangle Lektrik Iron.

New Toronto Address

R. E. T. Pringle, manufacturers' agent, announces his new office address, Room 308-309 Tyrell Building, 95 King street east, Toronto. Former office, 616 Continental Life Building, has been moved to the above address, as is also the Windsor office. While Mr. Pringle will make his head office at above Toronto address, Mr. A. Ross Oborne will continue, as previously, to have charge of all Ontario business.

Lecture on Lamps

Mr. E. W. Sayer, of the Sayer Electric Company, Montreal, lectured on the subject of electric lighting, at the Nomad's Club. Mr. Sayer spoke of the various lamps on the market and their merits, and also gave detailed information concerning various forms of public lighting. People in general were, he said, of the opinion that by using 16 c.p. carbon lamps they were practising economy, whereas if they used 40 watt tungsten lamps they would not only be consuming less current, but getting 100 per cent. better light, Factories and stores were realizing this fact and today were using the tungsten lamp entirely.

Tungsten Sign Lamps

The Canadian Tungsten Lamp Company have recently installed a department for the manufacture of tungsten sign lamps of 5-watt capacity, 12 volts. They report that orders received to date have justified them in placing these lamps on the market, and that they are assured of the greater adaptability and saving properties of this type of lamp as compared with the old carbon. These lamps can be run with from 50 to 75 per cent. less energy than carbon lamps and at the same time give a much whiter light, which is claimed to make a sign of any description more attractive.

Miscellaneous

The retirement of Mr. E. O. Sessions as a member of the firm of Woodmansee, Davidson & Sessions, consulting engineers, Chicago, is announced. Mr. Sessions is a Fellow of the American Society of Electrical Engineers, a member of the American Society of Mechanical Engineers, associate member of the American Society of Civil Engineers, and a member of the Illuminating Engineering Society. His plans for the future have not yet been made public, but will be announced at an early date.

The Siemens Company of Canada were recently awarded a contract for two 1900 h.p. peak-load electric hoisting machines for the Dominion Coal Company, N.S. The Siemens Company have already supplied the Coal Company with other large electric hoisting engines which have given satisfaction, the total of electrical machinery so supplied aggregating some 10,000 horse power.

The Imperial Wire & Cable Company, Montreal, have recently secured orders from the city of Edmonton, and the Alberta and Manitoba Governments. These are for telephone wire, bare copper wire, rubber covered wire, etc.

The International Brotherhood of Electrical Workers, Montreal, are organizing with a view to increasing their rate of wages. The object is to get 35c an hour instead of the 33c an hour now paid.

Trade Publications

Pneumatic Tools—Issued by the Chicago Tool Company. Bulletin No. 126 on Compression Riveters and bulletin No. 129 on Hose, Hose Couplings, and Hose Clamp Tools.

P. & S. Bulletin—No. 760 issued by the Pass & Seymour, Inc., Solvay, N.Y., describing a large number of electric sign installations in which P. & S. receptacles have been used.

Cling-Surface Treatment for Ropes—is the title of a bulletin just published by the Cling-Surface Company, Buffalo, N.Y. This bulletin shows a number of noteworthy treated rope drives; gives technical data, and carefully describes them all.

New Style Panel Board—Descriptive hanger being distributed by the Crouse-Hinds Company of Canada, Limited, descriptive of their type H panel board which is made in 224 standard forms. A distinguishing feature of this board is the 10 ampere, double pole indicating snap switches designed exclusively for panel board branch circuits. This is claimed to be the safest and best panel to install where switches are to be operated by persons not familiar with electrical devices. The panels are furnished with main lugs, main fuse terminals, fuseless main switch or fused main switch. Type H panels can be mounted in any of fifteen types of steel and wood cabinets.

Weights—of Standard Panel Boards, Slate Frames, Door Linings, Boxes and Trimmings.—A booklet issued by the Crouse-Hinds Company of Canada, giving the weights for panel boards, slate frames, door linings, etc., illustrated in Bulletin No. 1, dated October 1, 1910. The information contained in this booklet should be especially valuable in determining shipping costs.

Eleven Words Per Second

A demonstration of the Pollak-Virag system of rapid telegraphy, with which, it is declared, 40,000 words can be dispatched per hour, was given by Antoine Pollak, the inventor, at New York, January 31. By means of a beam of light controlled by motions at right angles, the receiving machine produces written characters on sensitized paper. Owing to the rapid succession of impulses involved, the system is limited in its use over very long inductive iron-wire lines, although entirely feasible within present telephonic ranges using copper circuits. It is reported that during a recent demonstration in France messages were sent 900 miles with this system.

Business is not done by lying awake at night but by keeping awake during the day.

Current News and Notes

Amherst, N.S.

The Canada Electric Company, Limited, of Amherst, N.S., announce that they have discarded their d.c. generators and now have for sale two 75 kw. and two 55 kw. units in good condition.

Berlin, Ont.

Additions to the electrical service equipment are calculated to cost between $40,000 and $50,000 for the year 1913.

Berwick, N.S.

An electric lighting plant calculated to cost $15,000 is contemplated.

Bradford, Ont.

By a vote of 99 to 7 Bradford passed an enabling by-law requesting the Ontario Hydro-electric Power Commission to make a report on the cost and supply of Niagara power.

Brandon, Man.

A contract has been signed between the city and the Brandon Electric Light Company for the supply of power to the new street railway system. The rate is 2c per kw.h.

Calgary, Alta.

The annual statement of the Calgary Power Company shows gross earnings of $191,846, and net earnings of $151,707.

The Elbow River Suburban Railway Company are making application for a charter. It is said to be the intention to construct an electric line from Calgary along the Elbow River to Canyon Creek.

The price of electric light in Calgary in 1906 was 14c per kw.h. and 15 per cent. discount. After five years of successful municipal operation this rate has been reduced to 7½c per kw.h. with 10 per cent. discount.

Collingwood, Ont.

The rural telephone system operating in Medonte township which at the present time has approximately 300 subscribers, is reported to cost only $8.15 per annum per telephone. This includes interest on debentures, switching charges and upkeep.

Dauphin, Man.

For some months it has been apparent to the Fire and Light Committee that the continual increase of the lighting load in town was putting so great a strain on the present plant that it would be necessary to install new equipment. It is now recommended that an extra boiler, generator and condenser be installed at once. The committee also recommend that 40 ornamental 5-light standards be placed on Main street to be equipped with 50-candle power tungsten lamps, the standards to be 100 feet apart on each side of the road.

Duncans, B.C.

Tenders have been called by DuCane, Dutcher & Company for water turbines, generators, exciters, transformers and switching equipment.

Dundas, Ont.

The Water, Light & Power Commission contemplate the purchase of a synchronous motor.

Edmonton, Alta.

The Alberta legislature will appropriate the sum of $2,000,000 for telephone extensions during 1913. The plans of W. H. Harmer, Deputy Minister of Telephones, indicate that $900,000 will be required on rural lines, $700,000 for exchanges and $400,000 for long distance lines. The government report shows that there were in operation at the close of the year 6,689 miles of toll lines and 9,671 miles of rural lines connecting 7,120 rural subscribers and giving service to 14,696 exchange subscribers.

A by-law passed on February 24th to expend $1,543,220 on street railway extensions.

A by-law passed February 24th authorizing extensions to the electric lighting system, costing $453,000.

A by-law passed February 24th authorizing extensions to the municipal telephone system, costing $848,260.

A by-law passed February 24th to provide additional power house equipment to the extent of $485,000.

According to the amalgamation agreement between Strathcona and Edmonton, tracks were to be laid on 6th avenue south, on Main street to 7th street west, and north to 8th street and University avenue, along to White street, by December 31st, 1913. The city commissioners recently advised against the laying of these tracks on account of the absence of pavements on these streets and for other reasons, but it has since been decided that the agreement with Strathcona must be carried out to the letter.

Elmira, Ont.

Arrangements have been completed between the town and the Elmira Milling Company by which the Elmira electric distribution plant will be taken over by the town at a value of $3,000 and operated as a municipal enterprise. It is understood that power will be taken from the Hydro-electric Commission.

Fredericton, N.B.

It is reported that the Fredericton Street Railway Company will construct a railway to connect Fredericton with St. Marys, Gibson and Marysville, about 5 miles.

Galt, Ont.

The Bell Telephone Company recently acquired a property on Ainslie street, with a frontage of 50 ft. and a depth of 240 ft. It is understood an exchange will eventually be built on this site.

Hamilton, Ont.

The Holman Electric Sign Company has been taken over by Hamilton men and a new charter applied for. The new directors are Robt. Junor, president and general manager, F. W. Hulme, vice-president and sales manager, and J. C. Stewart, secretary-treasurer.

The meter contract for the 1913 supply has been finally awarded as follows: Canadian General Electric Company, single phase, two-wire meters, 1200-10 amp., 150-25 amp., 40-50 amp., and 10-75 amp. Chamberlain & Hookham Meter Company, single phase, two-wire meters, 2000-5 amp., 200-18 amp., and 5-100 amp.; also 220 volt, 3-phase unbalanced power meters, 150-5 amp., 50-10 amp., 20-25 amp., 10-50 amp. and 10-100 amp.; and 550 volt, 3-phase unbalanced power meters, 50-5 amp., 50-10 amp., 25-25 amp., 10-50 amp., and 10-100 amp. The Canadian Westinghouse Company, 110 and 220 volt, three-wire, single phase meters, 200-10 amp., 100-25 amp., 20-50 amp., and 10-100 amp. Contract for all sizes of transformers was awarded to the Canadian Westinghouse Co.

Contract has been awarded to the Canadian Westinghouse Company for equipment for the Hughson street transformer station.

It is expected that the cost of extensions for the current year to the hydro-electric system will exceed $100,000.

Kamloops, B.C.

A flour milling company who are contemplating the erection of a plant in the vicinity of Kamloops have asked rates on the immediate supply of 75 h.p., this amount to be increased to 500 h.p. It is said a 1½c per kw. hour rate will be offered this company as an inducement.

Knowlton, Que.

A fire alarm will be purchased and installed throughout the town.

London, Ont.

General manager Glaubitz is reported to advocate the pumping of water into the reservoir at Springbank during off peak hours, this water to be used for developing power to help carry the peak load. It is said that 500 h.p. for two hours could be obtained in this way.

Plans are in progress for a hydro-electric line from London to Dorchester.

Electrical extensions to the amount of about $125,000 will be made during the year which will include the following equipment: new work shops; new sub-station equipment including power transformers, lighting regulators and synchronous motor; power generation plant at Springbank; sub-station No. 4 with equipment; line transformers; light and power meters, etc.

At the annual convention of the Associated Board of Trade of the province of Ontario held here on February 27th and 28th, an important resolution was passed asking that the Hydro-electric Commission be given power to undertake a system of electric railways throughout the province.

Shareholders of the Woodstock, Thames Valley and Ingersoll electric railway have moved for the appointment of a receiver for the road on the ground that it is not paying expenses.

Montreal, Que.

Tenders are being called for supplies for underground conduit system from Guy street along St. Catherine to Papineau avenue.

The Montreal Tramways Company have taken out an inscription in appeal against a judgment of Mr. Justice Charbonneau calling upon the company to produce a document in the case of Vipond vs Lovett, which is an action concerning the promotion of two power companies, the control of which passed into the Tramways and Canada Light & Power Companies.

At a meeting of the Montreal Electrical Society, Mr. L. R. McDonald, of X-Rays, Limited, read a paper on "X-Rays in Theory and Practice." After tracing the history of electricity, he discussed the production and effects of the rays, alluding to their penetrative powers. Mr. J. P. Thornton showed a number of slides illustrating the working of the rays, particularly in surgical cases.

The Northern Electric and Manufacturing Company, Limited, Montreal, have issued a calendar, with special features. The upper portion represents the Northern hemisphere, above which is suspended 110 volt 25 watt tungsten lamp (with the words "Northern Light" in the centre), diffusing light over this part of the calendar. Beneath the dates are descriptions of Northern light lamps, together with the firm name and address. The calendar is of very neat design, and well adapted to its purpose.

Mr. Arthur Surveyer, of Surveyer & Frigon, consulting engineers, Montreal, has been offered by the government a position on the Waterways Commission. The government are anxious that both he and Prof. C. H. MacLeod, of McGill, and secretary of the Canadian Society of Civil Engineers, should devote their whole time to the Commission, but these gentlemen, we understand, do not see their way to give up their present positions. They are, however, willing to devote a portion of their time to the Waterways Commission, and the government have this question now under consideration. Prof. MacLeod, Mr. Arthur Surveyer and Mr. W. I. Gear, were members of the old Waterways Commission, but Mr. Gear resigned on the change of government.

Yet another hydro-electric scheme is proposed for Montreal. As yet the promoters will not give out details, except to say that the financing is being arranged and that a company with a capital of about four million dollars is being formed. Sometime ago Heron Island, near Lachine Rapids, was purchased by Mr. J. J. Westgate, president of the Hudson Bay Knitting Company, Messrs. Holland and Hingston being associated with him in the deal. The island contains 180 arpents, and is admirably situated. The intention is to build a power plant and to supply current to Montreal.

Mr. Evariste Champagne has entered an action against the Montreal Public Service Corporation for $194,418. Mr. Champagne was the organizer of the Saraguay Electric & Water Company, whose territory was afterwards enlarged. In 1909 he was made manager. The Public Service Corporation afterwards bought the undertaking, and he asserts that the changing of the name and control has affected his engagement, and he asks to be paid the sum claimed for the loss of privileges and position.

The city of Winnipeg has awarded a contract to the Canadian British Insulated Company, Montreal, for a supply of extra high tension cable.

Moose Jaw, Sask.

Tenders are called till March 26th for one fuel economizer with 7,000 sq. ft. heating surface, and one induced draft plant to handle 120,000 cu. ft. of gases per minute.

North Battleford, Sask.

At the present time the electrical department are busy installing a lot of new machinery in the power house. The work is in charge of Mr. M. D. Cadwell, electrical superintendent.

Oak Bay, B.C.

It is reported that the Council will prepare cost estimates on lighting by cluster lights the whole length of Oak Bay avenue within the municipal limits.

Ottawa, Ont.

By a recent act of the Dominion Parliament, letter carriers in the service of the post office department shall be conveyed on every electric railway in Canada on such terms and conditions and under such regulations as are made by the Postmaster General.

The city council electrical department have planned equipment and extensions to station, for lighting purposes, to cost $22,000.

The Ottawa Electric Railway Company contemplate the erection of a sub-station at a total cost of $75,000.

The Ottawa Electric Railway Company contemplate the double tracking of 1½ miles on Creighton street, from St. Patrick to Sussex street, with 75 lb. rails.

Tenders were called to March 10th for meters, transformers, incandescent lamps, arc lamp globes, carbons and sundry supplies.

Tenders will be called by the Morrisburg & Ottawa Electric Railway, Canada Life Building, Ottawa, for requirements for 15 miles of track.

The City of Ottawa Electrical Department contemplate the purchase of ornamental standards and globes for a white way system recently adopted by the Board of Control.

The Canadian Minister of Railways has decided to establish wireless telegraphy between Le Pas and the Hudson Bay terminal when the harbor work is started. This will allow the department at Ottawa to keep in close touch with the progress of the work. Extensive preparations are being made to send north an expedition with dredges and equipment to start work on the harbor at the earliest possible date. The government will likely do most of the work itself, as it is not practicable to call for tenders for work as far away as the Bay.

The Railway Commission have made an order requiring the C. P. R. to accept and transmit trans-Atlantic messages for the Marconi Company over the C. P. R. land lines. Bad weather in the east has interfered with the service between Montreal and Glace Bay, and the Marconi Company wanted an alternative route in case of interruption on the G. N. W. lines.

Port Arthur, Ont.

Tenders will be received up to March 31 for the supply of the following railway material: Tender A.—8 tons No. 2/0 round trolley wire; 6¾ tons No. 4/0 flexible feeder wire, D. B. W. P. Tender B.—24,200 ft. 80 lb. 5-in. T rails; 50,000 ft. 60 lb. 5-in.. T rails; 76,500 spikes, 5½ x 9/16; 840 pair angle bars, 80 lb. rail, four hole; 1700 pair angle bars, 60 lb. rail, four hole; 6800 bolts 3¾ x ¾, hex. nuts; 3,360 bolts 4⅜ x ⅞ hex. nuts. Tender C.—Steel intersections, frogs, switches, etc.

Portage la Prairie, Man.

It is said that the radial line connecting Portage la Prairie with Winnipeg, will be commenced this summer and will be completed within two years.

Rapid City, Man.

It is reported there are three small water falls, one within the town limits and the other two just outside the town at which approximately 500 h.p. can be developed in each case under a 15-foot head.

Regina, Sask.

As a result of the difficulty experienced in getting industries to locate in Regina the city commissioners have recommended that the city undertake to supply power up to a limit of 1,000 h.p. at a rate of 1.1c per kw.h., which is equivalent to a rate of $30.11 per h.p. for 365 days of 10 hours each. A by-law was submitted on February 25th, asking authority to spend the necessary money.

Tenders are received till March 29th for weatherproof copper wire, cedar poles, cross arms, top-pins, insulators, pole-line hardware, pole-type transformers, meters, metal flame arc lamps and station equipment, series cut-out mast arms for arc lights, underground material and fire alarm boxes and gongs.

Saskatoon, Sask.

The meter supply for 1913 requirements was distributed as follows: 1200-5 amp. to Canadian Westinghouse; 200-10 amp. and 100-20 amp. to Feilman & Jardine, Winnipeg; 100-40 amp. to Chapman & Walker; 40-80 amp. to Chamberlain & Hookham, and 20-100 amp. to Ferranti. The Canadian General Electric get the contract for insulators, lamps, globes, fuse plugs, etc. The Western Electric supply the transformers.

Tenders will be received up to April 15th for 1 motor pumping engine of 500 gallons capacity, 1 motor pumping engine of 1,000 gallons capacity. Tenderers to quote on their own specifications.

A by-law authorizing the operation of Sunday cars in Saskatoon carried by a large majority. Other by-laws including street railway and electric light extensions carried to the amount of $782,000.

Souris, Man.

The Manitoba Government Telephone Department have just completed the installation of a central energy telephone system replacing the old magneto system originally in force.

St. John, N.B.

An offer has been submitted for the purchase of the St. John electric railway system. It is said the equivalent of $150 a share or a sum of $1,200,000 was offered for the common stock. With the exception of the president, Mr. Jas. Ross, of Montreal, all the directors of the company reside in St. John.

The profits of the St. John Railway Company for the year 1912 after providing for interest and all charges, amounted to $10,158, as profit and loss account now stands at $132,091. This road is bonded to the extent of $1,160,000 with capital stock $800,000.

St. Thomas, Ont.

City Engineer Baker will prepare estimates of the cost of a renewal of the road bed and track of the street railway system on Talbot street.

Swift Current, Sask.

Tenders will be received till March 31st for 1 200 kw. and 1 400 kw. a.c. generators, direct connected to high speed vertical engines or horizontal turbines.

Sydney, N.S.

The profits of the Cape Breton Electric Company for 1912 are said to show a considerable increase over the previous year. It is estimated that $200,000 will be expended on extensions during 1913.

Toronto, Ont.

The Board of Control has decided in favor of the city taking over the franchise of the Humber Valley Electric Railway Company. A by-law will be submitted to the people asking authority to spend the necessary money to build this road.

Application is being made to the Ontario legislature for an Act amalgamating the North Lanark Railway Company with the Ottawa and St. Lawrence Electric Railway Company under the name of the Ottawa and St. Lawrence Electric Railway Company, and increasing the capital stock from $1,000,000 to $5,000,000.

A charter has been granted the Forest Hill Electric Railway Company to build five miles of line in the northwestern part of the city of Toronto. The condition is attached that $50,000 must be spent within the year and the city has the right to take over the line at the end of five years.

A deputation of representatives of the municipalities interested in building a Toronto to Port Perry electric railway line recently waited on the Ontario government asking that the Hydro-electric Power Commission construct and operate this line. Premier Whitney and Hon. Adam Beck both expressed themselves as being in sympathy with the scheme but pointed out that a precedent of this kind would probably mean a tremendous demand from other parts of the province. The government will take the matter into its serious consideration.

Valois, Que.

Tenders will be called after April 1st for the installation of waterworks, electric light station and sewerage system.

Vancouver, B. C.

At the request of the Institute members in Vancouver and vicinity, the Board of Directors has authorized the holding of the annual Pacific Coast Convention of the A. I. E. E. at Vancouver, B.C., on September 9, 10 and 11, 1913. The Vancouver Section has been working for some time in preparation for this convention, and has already arranged for a number of papers, and plans are maturing for interesting trips to some of the large hydro-electric installations in the vicinity of Vancouver. Arrangements are being made for special rates over all railroads, and as this will afford to the engineering fraternity an excellent opportunity for visiting this region so interesting from the point of view of hydro-electric development, it is expected that a large attendance from the east, as well as from the west, will be assured.

Vernon, B.C.

On March 10th by-laws were submitted in Vernon as follows: $15,000 for extensions to the power house; $50,000 for the purchase of electrical generating equipment; $35,000 for the reconstruction of the electric lighting system.

Winnipeg, Man.

Five 500 kw. transformers for the terminal station and No. 1 sub-station may be purchased.

City electrician, F. A. Cambridge, contemplates extension to the fire alarm system. Switchboard, batteries, etc., $10,000. Owner, Board of Control. Secretary, M. Peterson.

The purchase is being considered of 1 150 h.p. squirrel cage, constant speed, induction motor, 3-phase, 550 volts, 60 cycle, 720 r.p.m., and 1 40-h.p. squirrel cage, constant speed, induction motor, 550 volts, 3-phase, 60 cycle, 1200 r.p.m., for the city quarry at Stony Mountains.

Contract has been awarded to the Canadian General Electric Company for 3 2700 kw. transformers.

Woodstock, Ont.

The Woodstock and Northampton Telephone Company, Limited, are applying for incorporation. It is proposed to build and operate a telephone business in the parishes of Northampton and Woodstock and in the town of Woodstock.

Tenders for Supplies

Sealed tenders, registered and clearly marked on the outside of envelope, "Tenders for Electrical Department Supplies," and addressed to the City Commissioners, Regina, Saskatchewan, will be received up until noon of **March 29th, 1913**, for the supply of:—

Section No. 1.—Weatherproof copper wire.
Section No. 2.—Western cedar poles.
Section No. 3.—Cross-arms.
Section No. 4.—Top-pins, insulators, etc.
Section No. 5.—Pole line hardware.
Section No. 6.—Pole type transformers.
Section No. 7.—Integrating watt meters, single, polyphase and two rate.
Section No. 8.—Metal flame arc lamps and station equipment.
Section No. 9.—Series cut-out mast arms for arc lights.
Section No. 10.—Underground material.
Section No. 11.—Fire alarm boxes and gongs.

Price to be F. O. B. Regina.

Copies of specifications may be had from E. W. Bull, Superintendent of Light and Power, Regina, Sask.

A marked cheque covering 5 p.c. (five per cent.) of bid must accompany each tender.

The City Commissioners reserve the right to reject any or all tenders.

E. W. BULL,
Superintendent of Light and Power.

5-6

PROCURED IN ALL COUNTRIES
LONG EXPERIENCE IN PATENT LITIGATION
SEND FOR HAND BOOK

PATENTS

PHONE MAIN 2582

RIDOUT & MAYBEE
59 Yonge Street
TORONTO, - - - CANADA

Moonlight Schedule for April, 1913

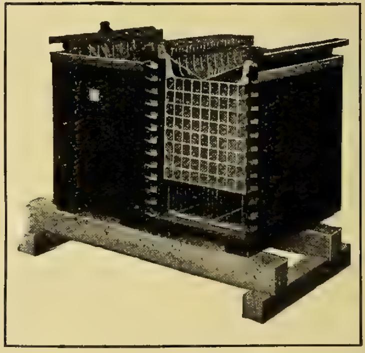
Courtesy of the National Carbon Company, Cleveland.

Date.	Light.	Date.	Extinguish.	No. of Hours
Apr. 1	6 50	Apr. 2	5 00	10 10
2	6 50	3	5 00	10 10
3	6 50	4	5 00	10 10
4	7 00	5	5 00	10 00
5	7 00	6	4 50	9 50
6	7 00	7	4 50	9 50
7	7 00	8	4 50	9 50
8	7 00	9	4 50	9 50
9	7 00	10	4 50	9 50
10	7 00	11	4 50	9 50
11	10 10	12	4 50	6 40
12	11 40	13	4 50	5 10
14	0 30	14	4 40	4 10
15	1 10	15	4 40	3 30
16	1 40	16	4 40	3 00
17	2 10	17	4 40	2 30
18	No Light	18	No Light	
19	No Light	19	No Light	
20	No Light	20	No Light	
21	7 10	21	9 40	2 30
22	7 10	22	10 50	3 40
23	7 10	24	0 10	5 00
24	7 20	25	1 10	5 50
25	7 20	26	2 00	6 40
26	7 20	27	2 40	7 20
27	7 20	28	3 20	8 00
28	7 20	29	3 40	8 20
29	7 20	30	4 10	8 50
30	7 20	May 1	4 20	9 00

Total Hours............189 40

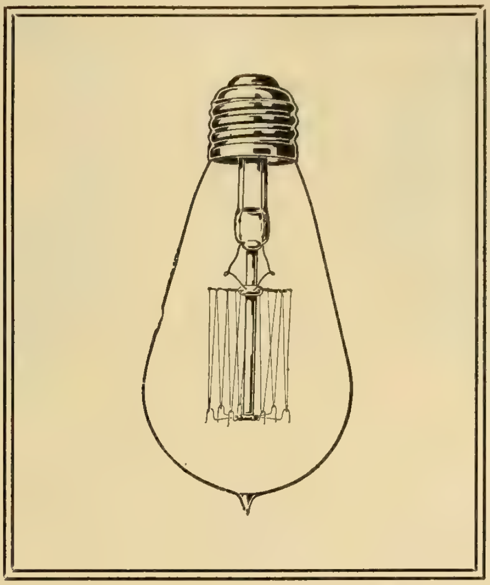
The D-P STORAGE BATTERY

Is Specialised for Train Lighting,
TELEPHONE & TELEGRAPH
(LAND, SEA, AND :: WIRELESS) ::
PRIVATE INSTALLATIONS,
Yachts, Portables.



CANADIAN AGENCY:
Messrs. O'LEARY & CO.
Montreal Vancouver Winnipeg

The D-P BATTERY Co., L^TD.
BAKEWELL, ENGLAND.
ESTABLISHED 1888. CODE: A B C, 5th EDITION.
CONTRACTORS to the ADMIRALTY and WAR OFFICE.



LACO QUALITY

Continuous Filament Drawn Wire Tungsten Lamps

Immediate Deliveries

All Standard Sizes and Voltages

Laco Philips Company

27 Common St., Montreal, Canada

SELLING AGENTS :—

F. Nicholas & Co., Ltd., Montreal - Winnipeg - Calgary - Vancouver
C. C. Bothwell, 249 Victoria Street, Toronto

Condensed Department

RATE

Positions Wanted }
Positions Vacant } 2 cents a word per insertion.
Miscellaneous. }

Tender advertisements, equipment for sale, etc., 15 cents per agate line (14 agate lines make one inch) per insertion.

Advertisers who wish to conceal their identity may do so by using an Electrical News box number without extra charge.

CITY OF SASKATOON

Machinery For Sale

One "Robb Armstrong" Horizontal Engine.

One "Canadian Westinghouse" Alternating Current Generator, 2 phase, 60 cycle, 125 kw., 2200 volts.

One Jet Condenser Air Pump.

Two "Canadian Foundry Company" Horizontal Tubular Boilers, each 250 h.p. capacity.

One "Robb Armstrong" Horizontal Engine, arranged for direct connection to a 225 kw. Generator on a 13-inch shaft.

One "Allis-Chalmers-Bullock" Generator—Rating 225 kw., 2200 volts, 2 phase, 60 cycles, 150 r.p.m.

Exciter, Allis-Chalmers-Bullock. Rating 104 amps., 120 volts, 1000 r.p.m.

Full particulars may be obtained on application to E. Hanson, City Electrical Engineer, Saskatoon.

Offers, endorsed on outside of envelope "Offer for Engines, Generators and Boilers," should be addressed to the City Commissioners, Saskatoon.

F. E. HARRISON, Mayor,
Chairman of Commissioners.

Saskatoon, March 5th, 1913. 6-7

For Sale

The Corporation of Hespeler will have for sale shortly:—

One 12 x 12 Goldie Ideal Engine, 315 r.p.m.

One C.G.E. 2300 volt, 26 ampere, single phase, 60 cycle Generator.

A number of 5 kw. Transformers and also a number of 60 cycle meters.

All of the above plant is now in commission and is being discarded, making way for a 25-cycle installation.

Kindly address any enquiries to the Chairman, Hydro-Electric Power Commission, Corporation of Hespeler, Hespeler, Ont. 6-7

For Sale

We have for sale the following machinery:—

1—200 kw. Westinghouse Composite wound 2200 volt, 2 phase, 570 r.p.m., 8000 alternations, generator.

1—2½ kw. 125 volt exciter for above with field and exciter rheostats.

5—125 K.V.A. 22,000-2200/1100 volt S. K. C. oil insulated, water cooled transformers, Station type, in boiler plate tanks.

15—Pole type, 1100/110 volt oil insulated transformers, 3 kw. capacity.

50—C.G.E. series enclosed arc lamps 6.6 amperes, 60 cycles.

2—C.G.E. 15 kw. Arc circuit regulators, 2200 volt, 6.6 ampere.

2—Marble switchboard panels and ammeters for arc circuits.

Quantity of switchboard marble, blue vermont and white, various sizes, drilled.

Orillia Water, Light & Power Commission,
6 Orillia, Ont.

Car Ventilating Systems

The Vacuum Car Ventilating Company has commenced manufacturing Mechanical Car Ventilating Systems under Canadian Patent No. 128070, dated September 13, 1910, and is prepared to furnish same on demand. For detailed information and prices, address Lock Box No. 25, Windsor, Ont. 10-t.f.

Situations Vacant

First-class meter man, capable of repairing and calibrating house and power meters, also making motor tests. State experience and salary expected. Northern Ontario Light & Power Company, Ltd., Cobalt, Ont. 4-7

Situations Wanted

Electrician, at present superintendent of a 1500 kilowatt hydro-electric plant in Ontario, desires to hear of similar or otherwise suitable position in the West. Twelve years' experience with Generation, Distribution and Installation of Electricity. Excellent references. Box 725, Electrical News, Toronto. 6

Electrician, eight years' experience in operating in large Hydro and Steam Power Houses, Construction and manufacturing, requires position. Prefer to manage small Hydro-electric plant, or as local superintendent. Excellent references. Aged 26, married. Moderate salary. Box 733, Electrical News, Toronto, Ont. 6

WANTED—Electrical operators and maintenance men for large power plant in the East. Permanent position with good prospects of advancement for the right men. Plant in small town located directly on the railroad, one hour railroad distance to larger city. Applications with full particulars to be sent to Box 738, Electrical News, Toronto, Ont. 6-7

UNION MOTORS FOR ALL INDUSTRIAL PURPOSES

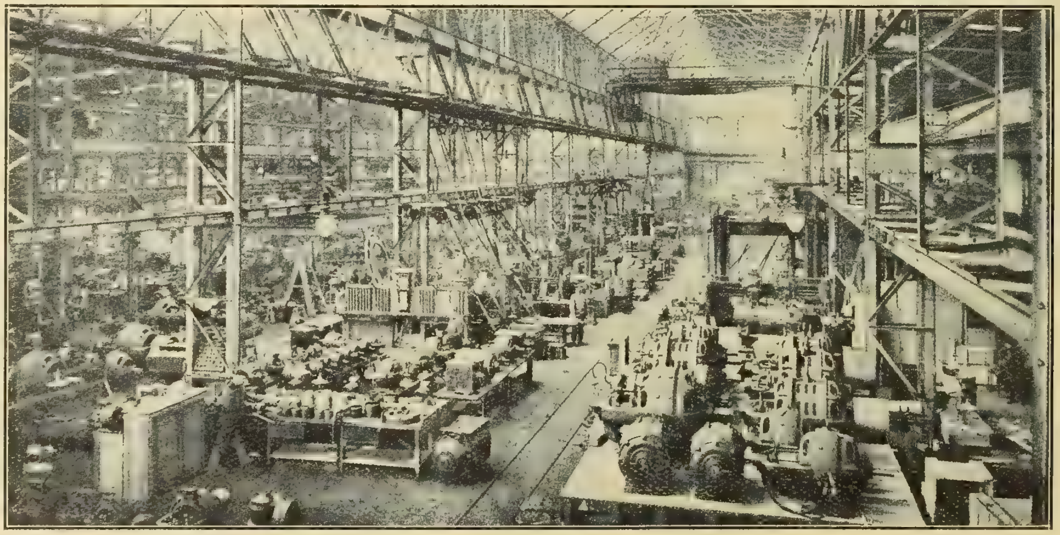
Stock carried in

Montreal - Toronto - Winnipeg

ARC LAMPS

DYNAMOS

MOTOR GENERATORS



TRANSFORMERS

STORAGE BATTERIES

INSTRUMENTS

A photographic view of one bay in the Factory showing Union Dynamos and Motors in process of manufacture.

Canadian Union Electric Co.
Limited
122 Wellington St. West, TORONTO—Tel. Adel. 3150
9 St. Nicholas St. Montreal

Mainer Electric Co., Limited
61-63 Albert St., Winnipeg, Man.
Representatives for Manitoba, Saskatchewan, Alberta.

WESTON
A. C.

Ammeters and Voltmeters, Wattmeters, Synchroscopes, Power Factor Meters and Frequency Meters, constitute a line of Switchboard Alternating Current Indicating Instruments which is unequalled. Send for our Catalogs giving full description of these instruments. They are accurate—durable—dependable—and we stand back of them.

Demonstrations of the operative characteristics of these remarkable instruments may be observed in our New York office, and also in the offices of Selling Representatives in Philadelphia, Chicago, San Francisco and Toronto.

Weston Electrical Instrument Company, Main Office and Works NEWARK, N. J.

New York, 114 Liberty Street.
Chicago, 1504 Monadnock Blk.
Boston, 176 Federal Street.
Philadelphia, 342 Mint Arcade.
Birmingham, Brown Marx Bldg.

Detroit, 44 Buhl Block.
St. Louis, 915 Olive Street.
Denver, 231 15th Street.
San Francisco, 682 Mission St.
Cleveland, 1729 E. 12th Street.

Toronto, 76 Bay Street.

Winnipeg, Montreal, Calgary, Vancouver } Northern Electric & Mfg. Co.

London, Audrey House, Ely Place, Holborn.
Paris, 12 Rue St. Georges.
Berlin, Genest St. 5, Schoenberg.
Johannesburg, So. Africa, F. Peabody Rice, Standard Bank Building, Harrison St.

BANNER TRADE MARK.

"Banner"
TRADE MARK

BANNER TRADE MARK.

Lighting Fixtures

Write to us for the latest designs in "up-to-date" electric fixtures.

Fixtures made from original drawings on short notice.

Ontario Lantern & Lamp Co., Limited,
HAMILTON, CANADA.

The West's Greatest Electrical Supply House

Ornamental Lighting Standards

Manufactured by the King Foundry Co., St. Josephs, Mich.

Latest Designs Excellent Finish

The "Century Single Phase Motors"

Adaptable to 110 and 220 Volt

Hundreds in use in Western Canada and everyone giving satisfaction. They take care of the small power requirements perfectly

The Famous "THOR" and "RED ELECTRIC"

Hurley Washing Machines

Over twenty thousand giving satisfaction in twenty thousand homes

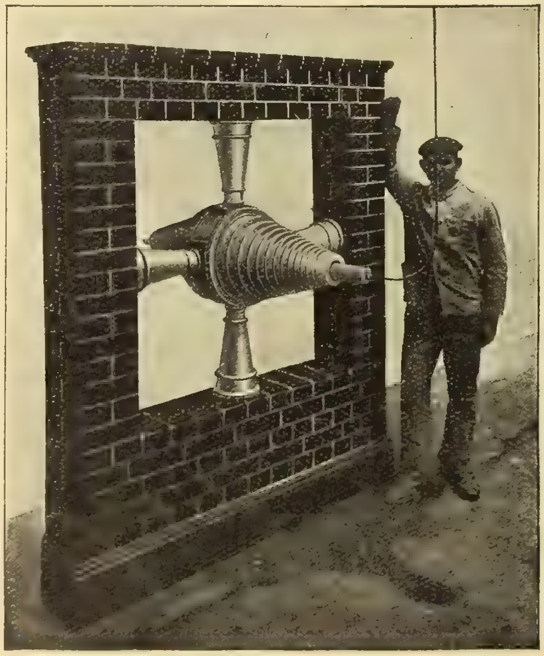
"Appleton" Unilets

The latest improved conduit fitting, made in all styles for all purposes. Once acquainted with these fittings, and you use them always. They are roomy and save time. Complete stock always on hand.

The Mainer Electric Company, Limited

Winnipeg, Man.

Porzellanfabrik Hermsdorf



Sachsen-Altenburg, Germany

Wall Duct for the High Tension Transmission Station of the

Hydro-Electric Power Commission of Ontario

110,000 Volts

Sole Agents for Canada

Watson Jack & Company

709 Power Building, MONTREAL

Rubber Covered Wires and Cables

For Power, Light and Telephone Work

INCANDESCENT LAMP CORD
FLEXIBLE SWITCHBOARD CABLES
Special Cords and Cables for all kinds of Electrical Work

Prompt Shipments from Canadian Factory

Boston Insulated Wire & Cable Co.

CANADIAN OFFICE AND FACTORY:

Hamilton, Ontario

Elliot Bros. Electrical Instruments

Electrical Machinery

The Lancashire Dynamo & Motor Company
of Canada, Limited 152-4 Bay Street, TORONTO

The MAN of the HOUR

He TELEPHONES instead of writing, walking, or riding, whenever he can, therefore saves energy and doubles his efficiency.

The more subscribers can be induced to telephone the greater will be the demand for your service and new contracts.

The better the telephones, the greater inducement to use them, and the better the service, the greater the need of it becomes. Here is where really fine equipment is the best possible directory builder.

The telephone today is not used but a fraction of what it will be a few years hence. Therefore, the better the apparatus (which means better service), the faster will its use spread.

Thousands of wasted steps are taken daily; thousands of pounds of shoe leather worn out uselessly, and what is perhaps the most important of all, hours of valuable time are thrown away; 90 per cent of which can be saved by telephoning.

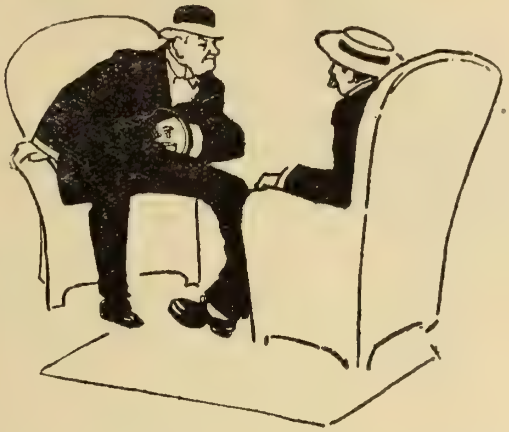
The highest class telephone service known to the telephone field today is exemplified in the Kellogg equipment. Every part in its construction is sound.

Send for our bulletins. They are REAL sources of information. Not merely a description of the apparatus but simple readily understood explanations of its operation.

KELLOGG SWITCHBOARD & SUPPLY COMPANY

MAIN OFFICE AND FACTORY: CHICAGO

REGINA BRANCH: DEERING ELECTRIC COMPANY, LIMITED - WINNIPEG BRANCH: HOUSTON & COMPANY
VANCOUVER BRANCH: B C. HOLST & COMPANY 43 LEIGH-SPENCER BLDG.



A Chat on Sales

If you have salesmen on the road are you paying them to do missionary work, scouting after prospects, when they may work more economically, effectively and on a much larger scale by following the definite leads our reports suggest?

Today, as never before, time is reckoned in dollars and cents. If your salesmen can save hours in searching for prospects, you save capital by coining it into money.

The greatest savers of time, effort and money for the business man of today are MacLean Daily Reports. They are the direct route from the man who is buying to the man who is selling. They enable your salesmen to devote their time in following up business after it has been located, instead of trying to locate it.

Our daily reports will tell you who are buying, what they are buying and when they are buying regarding any building material whatsoever and thus aid you materially in the sale of your products.

Any territory, any line, specialized to your individual requirements. Rates scaled according to the nature of your business and the territory to be covered. Send for our latest booklet and learn how we can help you in your business.

MacLean Daily Reports, Limited
220 King St. West, Toronto, Canada

"STANDARD" CABLE TERMINALS

stand for maximum protection to cable insulation, convenience and flexibility in operation and ease of installation.

Let us prove it. A card brings complete information.

Single Conductor D.O.A. Cable Terminal, Showing Method of attaching to Cross-arm.

Standard Underground Cable Co., of Canada, Limited
Hamilton, Ont.
Montreal, Que. Winnipeg, Man.
Boston, Mass. Seattle, Wash.

POLES Western Cedar PILING

We brag about the Service we give.

B. J. Carney & Co.

E. R. Brande, Manager, 819 Broad Street, Grinnell, Ia.
M. P. Flannery, Manager, 606 Pauslen Bldg., Spokane, Wash.

Commit us to memory.

NAUGLE **Pole & Tie Co.**
5 South Wabash Ave.
Chicago Illinois

Our yards are located adjacent to Canadian Territory which guarantees

Our Motto
Service Price Quality
Try Us Once

POLES

John Starr, Son & Co.
Limited
158 Granville St. - HALIFAX, N. S.

Electric Lighting Supplies

Lamps, Sockets, Rosettes, Wires, Cords, Conduit, Moulding, Switches, Cut-Outs, Fixtures, etc., etc.

Large Stocks - Prompt Shipments

Write Us for Low Prices

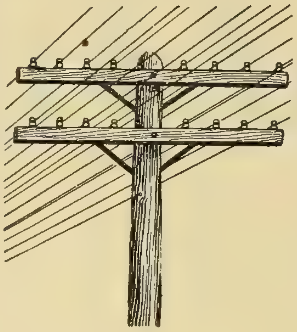
CEDAR POLES

CEDAR POLES

We have large stocks of them for prompt shipment at low freight rates.

National Pole Co.
Escanaba, Mich.

Cross-Arms

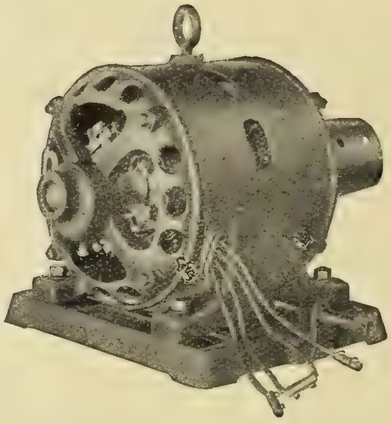


Our specialty is manufacturing Cross-Arms from sound straight-grained Douglas Fir.

No order too large for us to fill nor too small to receive careful attention.

Send us your specifications and get our prices before placing your orders.

Cameron Lumber Co.
Limited
Mills and Office - - VICTORIA, B. C.



Century

Single Phase Motors

are built to give constant uninterrupted service. Every part is strong enough to withstand much more than could be expected of a motor of the rated capacity.

They are all equipped with interchangeable voltage connections. (Standard being 104/208 volts). An ordinary knife switch is all that is necessary to start them. They are self-starting under full load.

¼ to 40 Horse Power 25 to 140 Cycles

Manufactured by

CENTURY ELECTRIC CO.
19th & Olive Streets - St. Louis, Mo.

Canadian Representatives

Jones & Moore Electric Co, Ltd.,
District Sales Agents,
291 Adelaide St. W.,
Toronto, Ont.

Hinton Elec. Co., Ltd.,
District Sales Agents,
Vancouver - Victoria
British Columbia.

The CANADIAN FAIRBANKS-MORSE CO., LTD.
Montreal, Calgary, Edmonton, Ottawa, Toronto, St. John, Vancouver, Victoria, Winnipeg, Regina, Saskatoon.

British Columbia Cedar Poles

Your orders will be shipped from Canadian yards exclusively.

Over 100,000 seasoned poles of guaranteed quality mean

"Good Poles Quick"

Get our prices before you place your orders for this season's requirements.

The Lindsley Brothers Co.

Spokane Washington

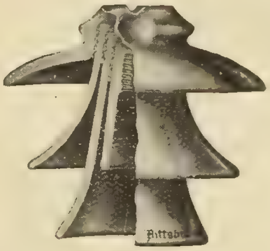
CRAWFORD POLES
in life, strength and appearance are all that telephone buyers can ask. Price is O. K. Write

Crawford Cedar Co.
Menominee, Mich.

"Pittsburg" Insulators

WHY YOU SHOULD USE THEM

QUALITY
DESIGN
UNIFORMITY
SATISFIED USERS



"PITTSBURG" Insulators

are designed and made to give the maximum efficiency under the most severe conditions. Uniform glaze, body and appearance. Made for voltages from 4,000 upward.

THE PITTSBURG
HIGH VOLTAGE INSULATOR CO.
Main Office and Factory, DERRY, PA.
Toronto Office, Telephone Building

Western Lumber and Pole Co.

24 Cedar Pole Yards

In B. C., Idaho and Washington. We Ship From Our

British Columbia Stocks
TO
Quebec Ontario Manitoba
Alberta and Saskatchewan Points

☛ Write for Delivered Prices on ☚

WESTERN RED CEDAR POLES

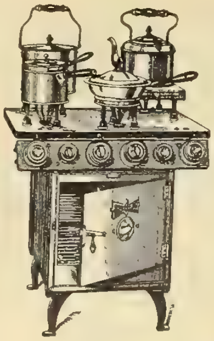
Western Lumber & Pole Co.
Main Office: DENVER, Colo.

Tenders

A few dollars spent in advertising your proposals in

The Contract Record

would result in additional competition, which might save your city or town or your client many hundreds of dollars.



More Simplex Electric ranges, Electric irons, etc. will be used this year than ever before.
You want to sell your proportionate share. Educate your customers early in Simplex goods before motor trips and other outdoor "distractions" make them harder to interest.
You want enough Simplex appliances to make an impressive display.

Send in your order now

SIMPLEX ELECTRIC HEATING COMPANY
BELLEVILLE, ONT.

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SAN FRANCISCO, 612 Howard St.

SIMPLEX QUALITY

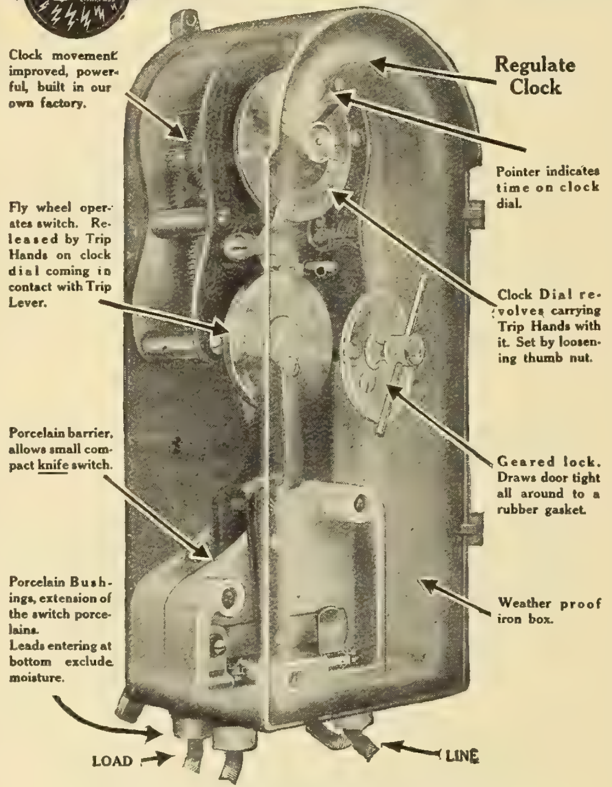
MICA
KENT BROTHERS
Kingston, Ont., Canada

Miners, Exporters and Dealers in Canadian Amber Mica.
Thumb Trimmed, Cut to Size, Splittings, Discs, Washers, Etc.

Write us for prices and let us figure on your requirements.

REG. U.S. PAT. OFF. TRADE MARK Campbell

CAMPBELL TIME SWITCH
THE BEST (PATENT)


Clock movement improved, powerful, built in our own factory.
Regulate Clock
Pointer indicates time on clock dial.
Fly wheel operates switch. Released by Trip Hands on clock dial coming in contact with Trip Lever.
Clock Dial revolves carrying Trip Hands with it. Set by loosening thumb nut.
Porcelain barrier, allows small compact knife switch.
Geared lock. Draws door tight all around to a rubber gasket.
Porcelain Bushings, extension of the switch porcelains. Leads entering at bottom exclude moisture.
Weather proof iron box.
LOAD
LINE

Send for Price List
CAMPBELL ELECTRIC CO., LYNN, MASS.
Canadian Representative—Irving Smith, 406-7 St. Nicholas Bldg., Montreal

"SHAWMUT"
Electrical Material

Enclosed Fuses
Fuse Blocks
Porcelain Cutouts
Fuse Wire and Ribbon
Fuse Links

Ground Connection Clamps
Nipples and Couplings
Stage Pockets and Plugs
Metal Cable Clips, Etc.

Manufactured by
CHASE-SHAWMUT CO.
Newburyport, Massachusetts

FRANK G. SCOFIELD
REPRESENTATIVE FOR ONTARIO
702 LUMSDEN BLDG. - TORONTO, ONT

Buy National Wirum Lamps

The kind that do not break and the only ones to retain their ductility through life

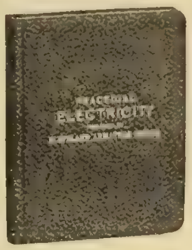
WRITE US FOR PRICES

National Engineering Company
Limited
11 St. Sacrament Street
MONTREAL
Telephone Main 48

ELECTRICAL MACHINERY
AND REPAIRS

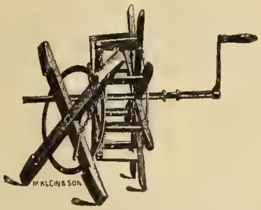
Armatures Complete
Armatures Rewound
Armature Coils
Armature Shafts
Field Coils

Commutators New,
Refilled or Assembled



Every electrician should have a copy of this book. Price - $2.00 delivered

CLEVELAND ARMATURE WORKS, Cleveland, Ohio



KLEIN'S
REELS

Give uniform satisfaction no matter how severe the service

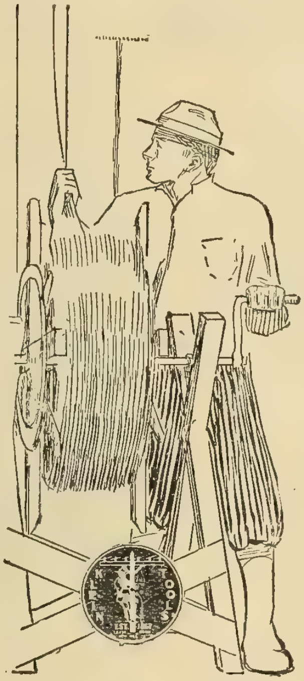
That's because they are made of selected oak, full mortised and bolted.

And in addition to being so well constructed, the improved take-up reel has a separate guard piece slipped on shaft and fastened with a flat key, allowing wire to be removed quickly and easily.

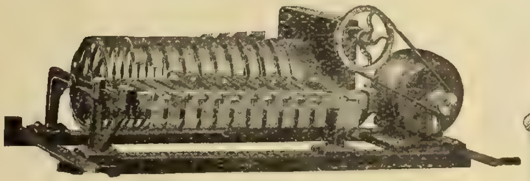
Best of all they don't cost more than old style reels.

Catalog 10 gives the news of the latest developments in linemen's and construction tools. Send for it.

Mathias Klein & Sons
Manufacturers
and jobbers of
Linemen's Electrician's
and Construction Tools
Canal Station 59
CHICAGO



RECO FLASHERS FOR ELECTRIC SIGNS AND DISPLAYS



Made in every style.

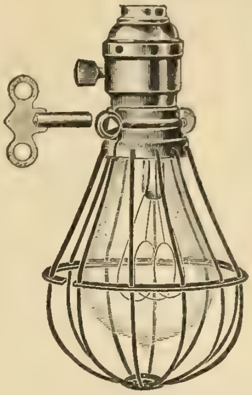
ADJUSTABLE -- SIMPLE -- DURABLE

COLORED LAMP HOODS

GET OUR LATEST BULLETINS

Reynolds Electric Flasher Mfg. Co.
Largest Manufacturers of Flashers in the World.
Also Manufacturers of Billboard Reflectors, Time Clocks, Transformers, Window Displays, etc.
No. 1123 Broadway, New York. No. 617-631 W. Jackson Blvd., CHICAGO

Its Two-Fold Protective Feature Makes It Doubly Serviceable



LOXON
LAMP GUARD
THE KEY TO SAFETY

The need for Protecting Lamps against theft as well as breakage is greater than ever in this day of Expensive Mazda Lamps.

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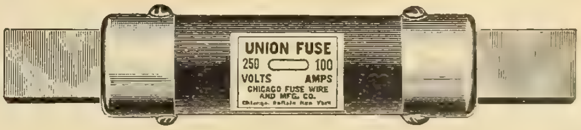

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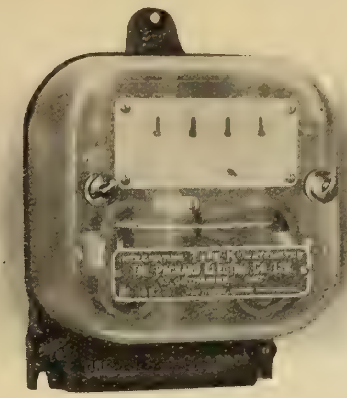

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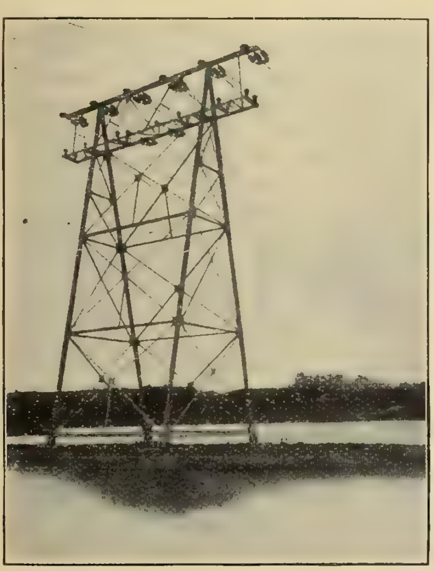

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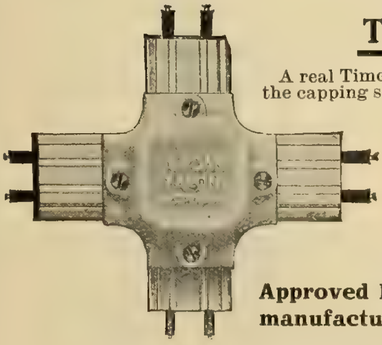

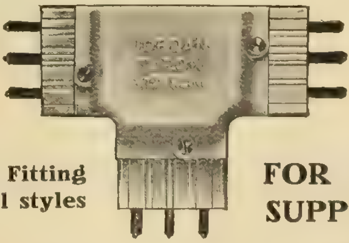

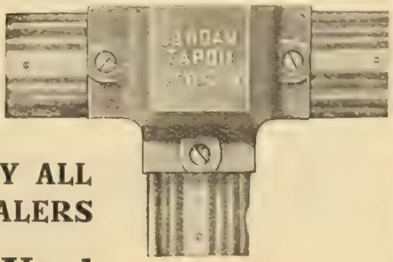

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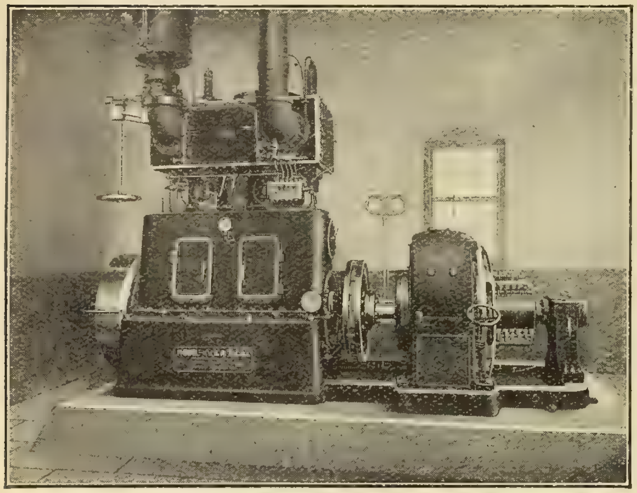

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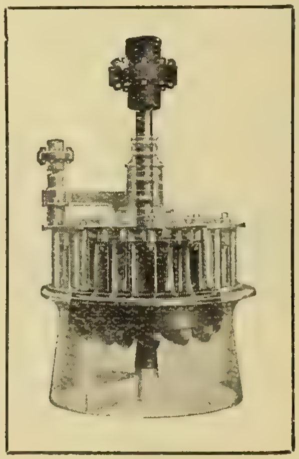

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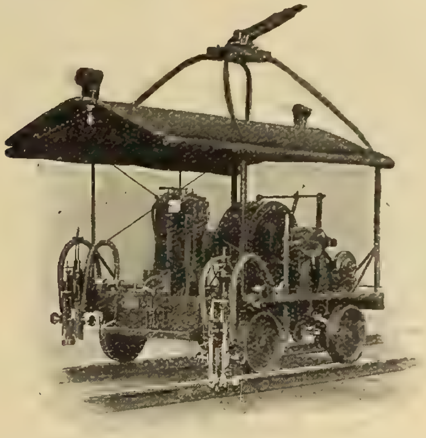

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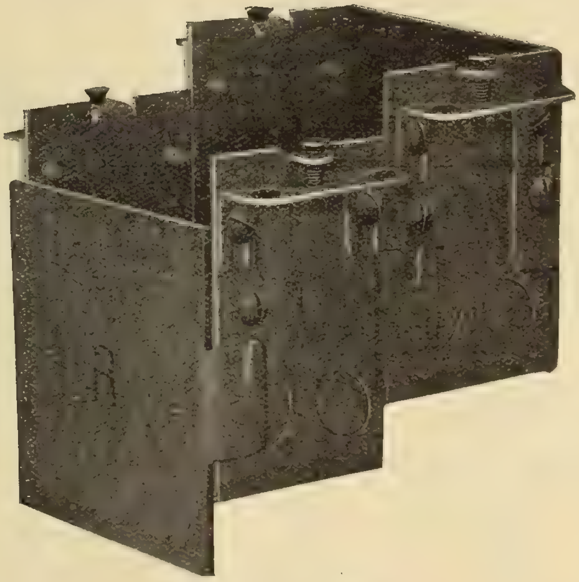

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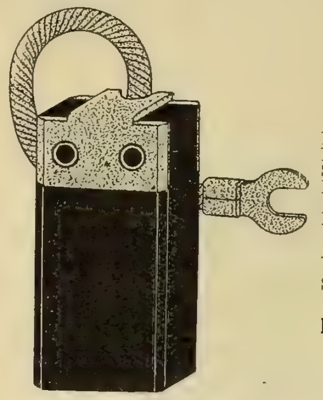

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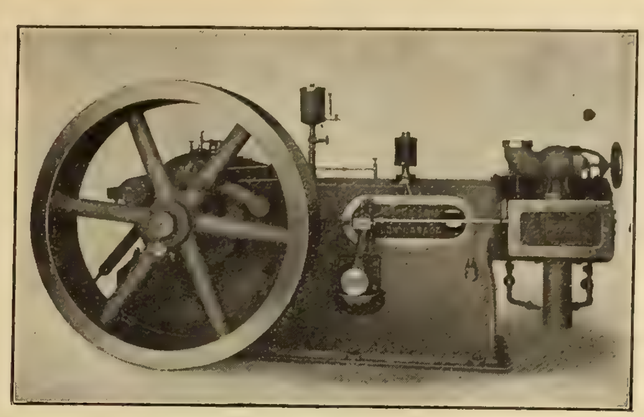

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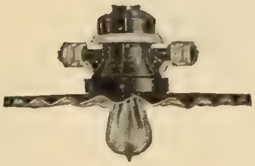

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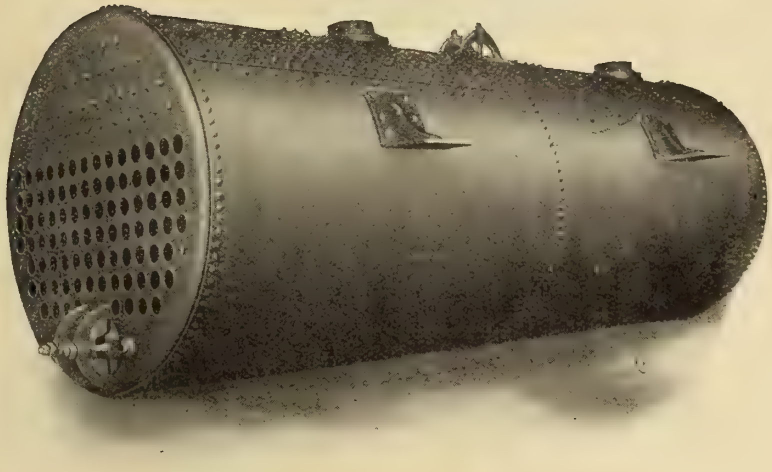

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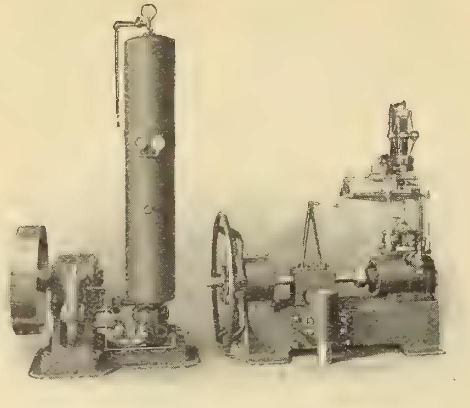

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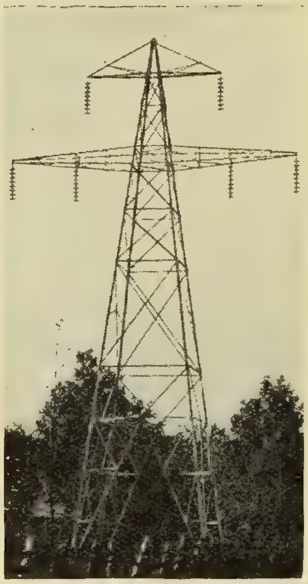

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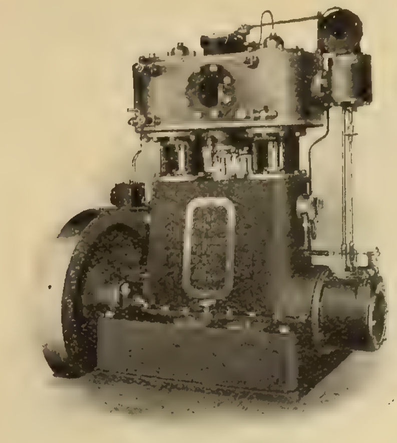

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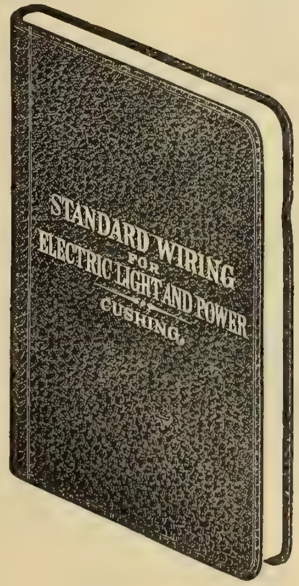

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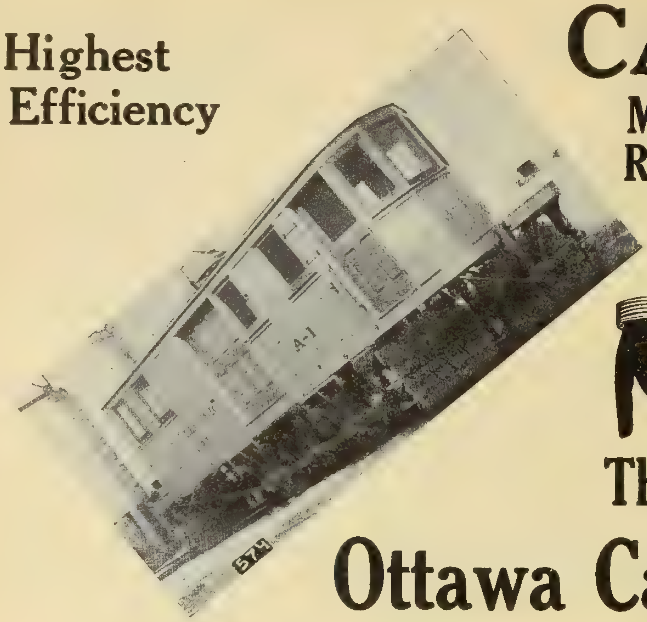

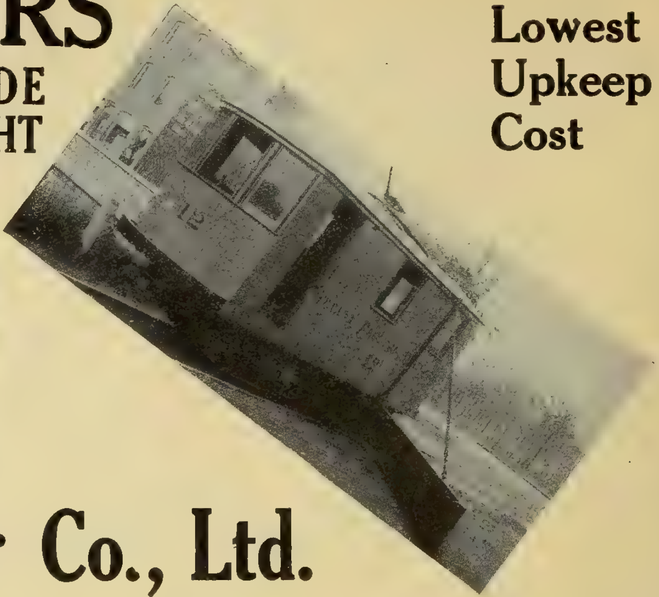

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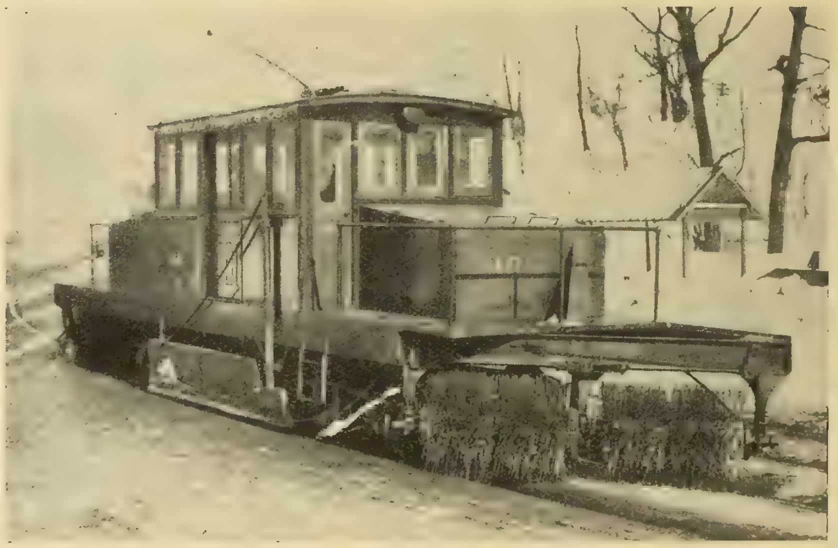

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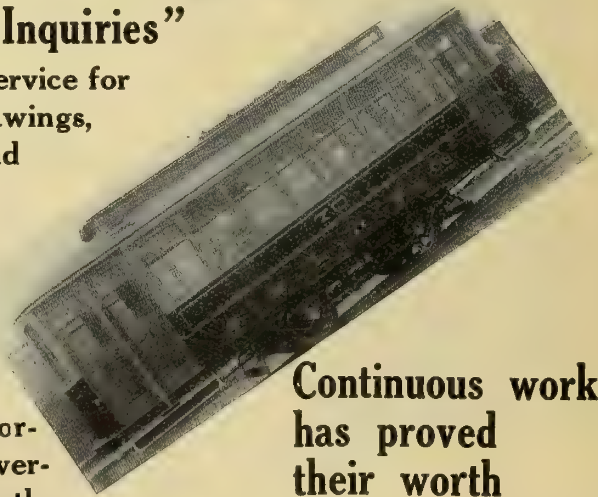

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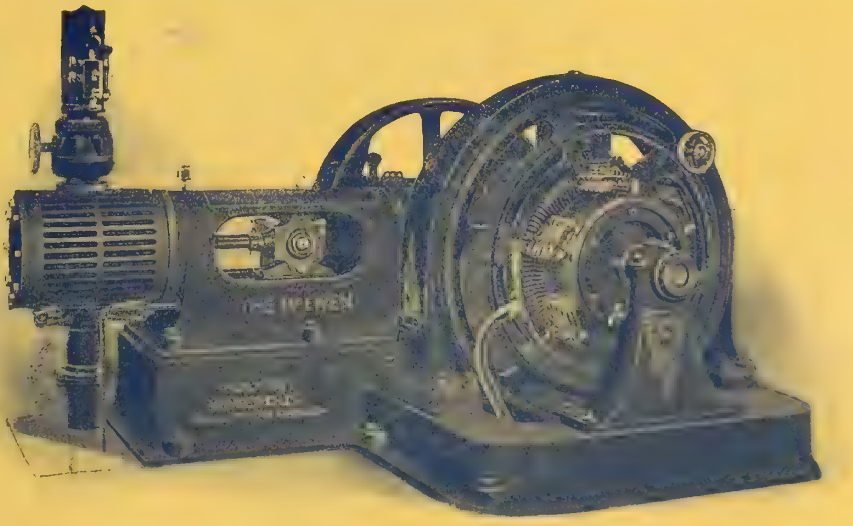
Does **your** plant stop operating when something goes wrong with the power transmission line? Don't be among the "thumb twirlers" when the juice is off.



A Waterous Boiler

A McEwen Automatic Engine

and an electric generator

in your own engine room, means cheap electric power and lots of it **all the time.**

Hundreds of isolated plant-owners in Canada will testify to this.

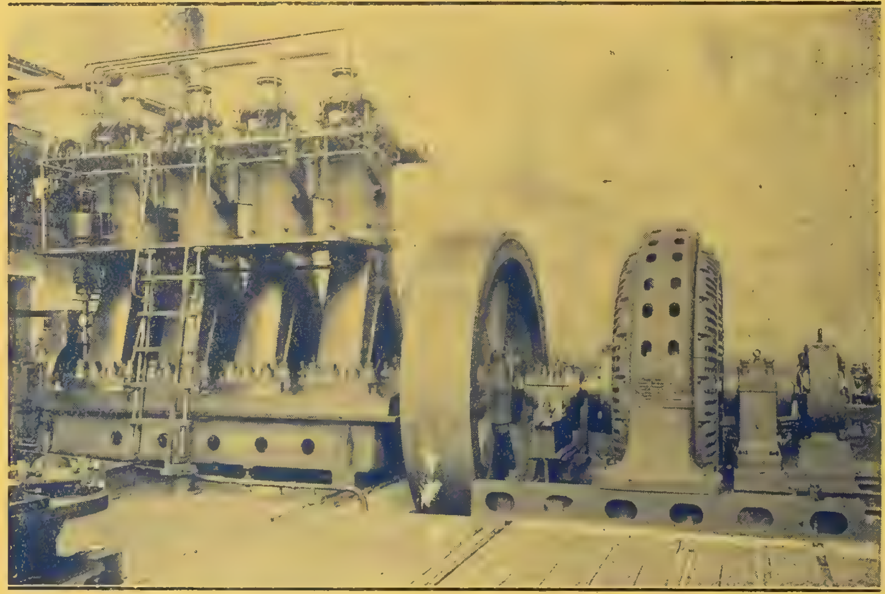
Send for our list of McEwen users and let us show you why.

Waterous Engine Works Co., Ltd. **Brantford, Canada**

DIESEL OIL ENGINES and STEAM TURBINES

Manufactured by Messrs. Willans & Robinson, Rugby, Eng.

200 K.W. WILLANS DIESEL OIL ENGINE



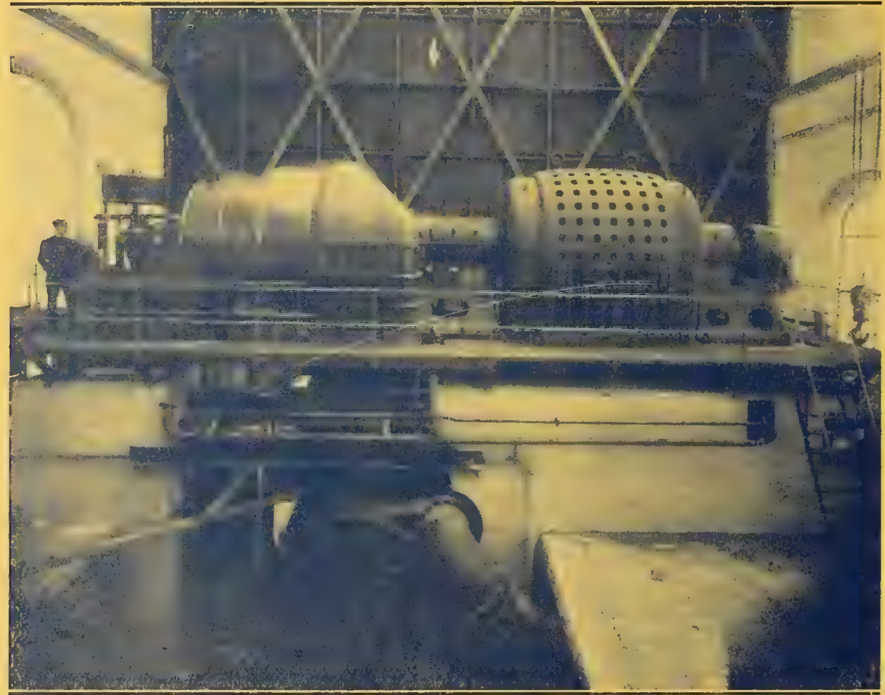
A reciprocating type, designed to utilize the Diesel principle of obtaining power from inexpensive heat producers such as crude oil, residues, etc; four cycle type.

Fuel cost—one fifth cent per b. h. p. An exceptionally efficient engine for driving electric generators.

Excellent as a stand by—can be started and got under full load in a few minutes.

for POWER PLANTS

5500 K.W. WILLANS DISC AND DRUM STEAM TURBINE



This turbine combines the Impulse principle at high-pressure end with the Parsons principle at low-pressure end, thus obtaining unusually high efficiency without impairing the reliability of the machine.

Over two hundred steam turbine plants installed by Messrs. Willans & Robinson within the past eight years, most of which are driving electric generators.

CANADIAN BRITISH ENGINEERING
COMPANY, LIMITED

324 Smith St.
WINNIPEG

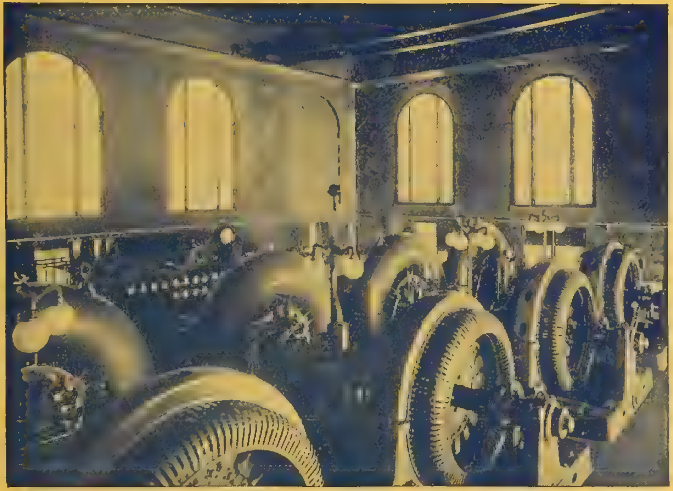
2 TORONTO ST.
TORONTO

4 Queen Victoria St.
LONDON, ENG.

Vol. XXII—No. 7 Toronto, April 1, 1913

Electrical News

Generation, Transmission and Application of Electricity



"Smith" Francis Turbines

Power house of the Metropolitan Water and Sewerage Board, Clinton, Mass. (now owned by State of Massachusetts), where we have four hydraulic turbine units, each of 1600 Horse Power, under 100 ft. head, in constant operation. Turbines designed for heads from 5 feet to 600 feet.

SEND FOR BULLETIN N

S. Morgan Smith Co., York, Pa.

Branch Offices: 176 Federal St., BOSTON, MASS.
614 American Trust Bldg., CHICAGO

Battery Charging Rectifier

Mercury Arc Rectifiers

Provide the ideal method of obtaining Direct Current from Alternating Current Services.

RELIABLE AND EFFICIENT SIMPLE TO OPERATE
ALWAYS READY FOR USE CLEAN AND COMPACT
NO ROTATING PARTS NO VIBRATION

8,500 Rectifiers are used for charging electric vehicles.

Moving Picture Rectifier

Canadian General Electric Co., Limited

Toronto Montreal Halifax Ottawa Cobalt Porcupine Winnipeg Regina
Saskatoon Calgary Edmonton Vancouver Victoria Nelson Prince Rupert

Alphabetical Index to Advertisers, Page 8

PHILLIPS

Electrical
Wires and Cables

Bare and Insulated Copper Wires and Cables.

Bare and Insulated Electric Wire and Cables for Aerial and Underground Use.

Railway Feeder and Trolley Wire.

Weatherproof Magnet and Rubber Covered Wires and Cables.

Incandescent and Flexible Cords.

Telephone, Telegraph, Lighting, Power and Street Railway Wires, Cables and Equipment.

Eugene F. Phillips Electrical
Works, Limited
MONTREAL - - CANADA
Branches: HALIFAX TORONTO WINNIPEG VANCOUVER

BENJAMIN NO. 91

DOES IT

Cat. No. 91

The new type 60 Watt Tungsten Lamp is being manufactured in the old 40 watt bulb size but with short base. This means all installations made with glassware or steel reflectors suitable for the old type long base 60 watt lamp will be unsatisfactory from viewpoint of appearance as well as distribution when re-lamped with the new 60 watt type.

BENJAMIN NO. 91 OVERCOMES THE DIFFICULTY

It screws permanently into the socket or receptacle and brings the filament of the new 60 watt lamp in proper relation with the reflector.

No. 91 extension also offers a convenient means for attaching glassware where the socket outlets do not otherwise permit. The shell is provided with a bead for taking standard shade holders. It increases the length of the socket only 1¼ inches and is especially serviceable in connection with flush sockets or ceiling Receptacles.

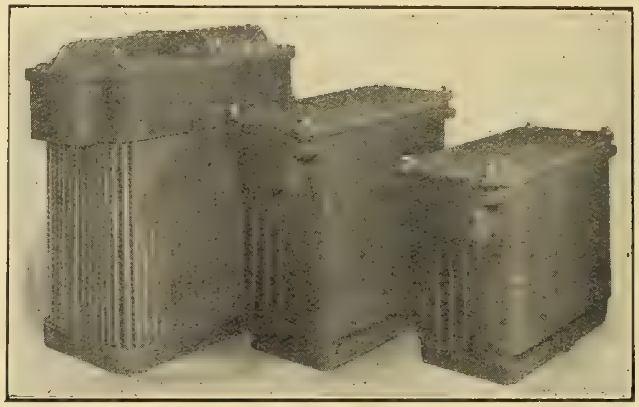
IF YOUR JOBBER CANNOT SUPPLY—WRITE US

Our new Catalog C-21 is now being mailed to the trade. If you don't get your copy—write

Benjamin Electric Mfg. Co. of Canada, Limited
11-17 Charlotte St., Toronto

FERRANTI

Transformers Meters



Three Phase Pole or Station Transformers

THREE phase pole oil immersed transformers have been proved the most satisfactory and efficient type. They effect a great saving in construction costs and reduce operating costs to a minimum.

In Ferranti high efficiency transformers all coils are wound with copper of ample sectional area, thereby reducing copper losses to a minimum. They are designed along simple and substantial lines and all parts are easily accessible.

In stock at Toronto and Winnipeg for prompt delivery at special prices—

100 to 300 Lamp Oil Switches
Motor Starters
Ammeters and Voltmeters
Portable Power Factor
Indicators &c.

Write us for particulars

Steel Case—Top or Bottom Connections

IF you are in the market for electric meters it will pay you to secure prices and particulars for Ferranti meters. They have many points of merit.

Simplicity of construction.
Perfect accuracy.
Cyclometer or clock dials.
Top or bottom connections.
Prompt deliveries.
Every meter carefully inspected before shipment.
Absolutely guaranteed.
Send us your probable meter requirements and let us make you a proposition.
Large stock and fully equipped repair and erection Shops at Toronto and Winnipeg.

The Ferranti Electrical Co. of Canada, Ltd.

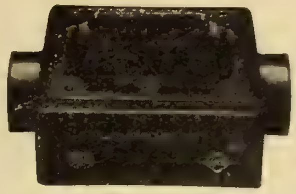
TORONTO
90 Sherbourne St.

WINNIPEG
56 Albert St.

Railway Condulets

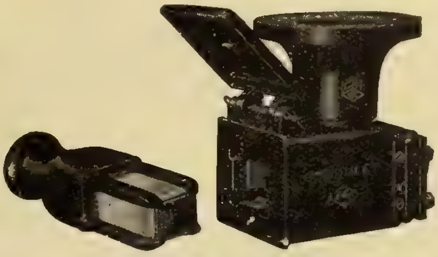
Type BLMC—For Bracket Lamp Outlets. Takes Round Base Fittings.

Type CLOC—For use with Centre Ceiling Fittings.

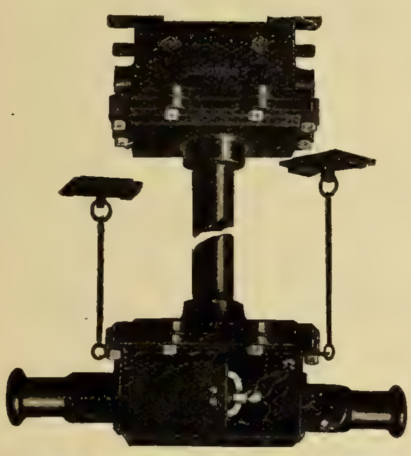

Type JRR—For use back of Moulding with Rectangular Base Fittings.

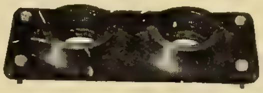
Type JRRH—Side Bracket Hood — For use with type JRR Condulet. Takes various Round Base Fittings.

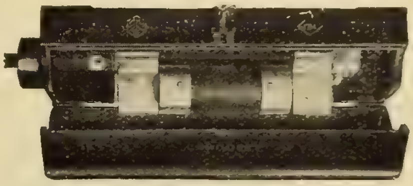
Type MD—Receptacle and Plug for Dynamo—Regular Connection.


Type BRHS with 100 Ampere Receptacle and Plug. Battery Charging Equipment for Car.

Type PJCA—Medium Size Weather-proof Junction Box.


Type UGC—Arranged as Yard Charging Equipment for Underground Conduit System.


Two-Hub Side Plate for Type RS Condulet.


Type FBL—Weather-proof Housing for 100 to 200 Ampere Battery Fuse.

The Condulets shown here are only a few of the many types designed to simplify and improve conduit installations in railway cars, buildings and yards. Whatever the requirement, we have a Condulet to meet it.

Type RS—Detachable Sides, Weather-proof Junction Box.

You can secure detailed illustrations, descriptions and listings of all Railway Condulets by signing the attached coupon and mailing it to us.

Order Condulets from your dealer. If he does not stock them, write us.

Crouse-Hinds Company of Canada, Ltd.

Main Office and Works:
Toronto, Ontario, Canada

Kindly send me free copy of Condulet Bulletin No. 101.
Name.............................
City.............................
Prov.............................
2313

ADANAC Red Core Rubber Covered

WIRES & CABLES

RUBBER COVERED
TRADE
ADANAC
MARK
WIRES AND CABLES

Adanac Red Core Rubber Covered Wires and Cables

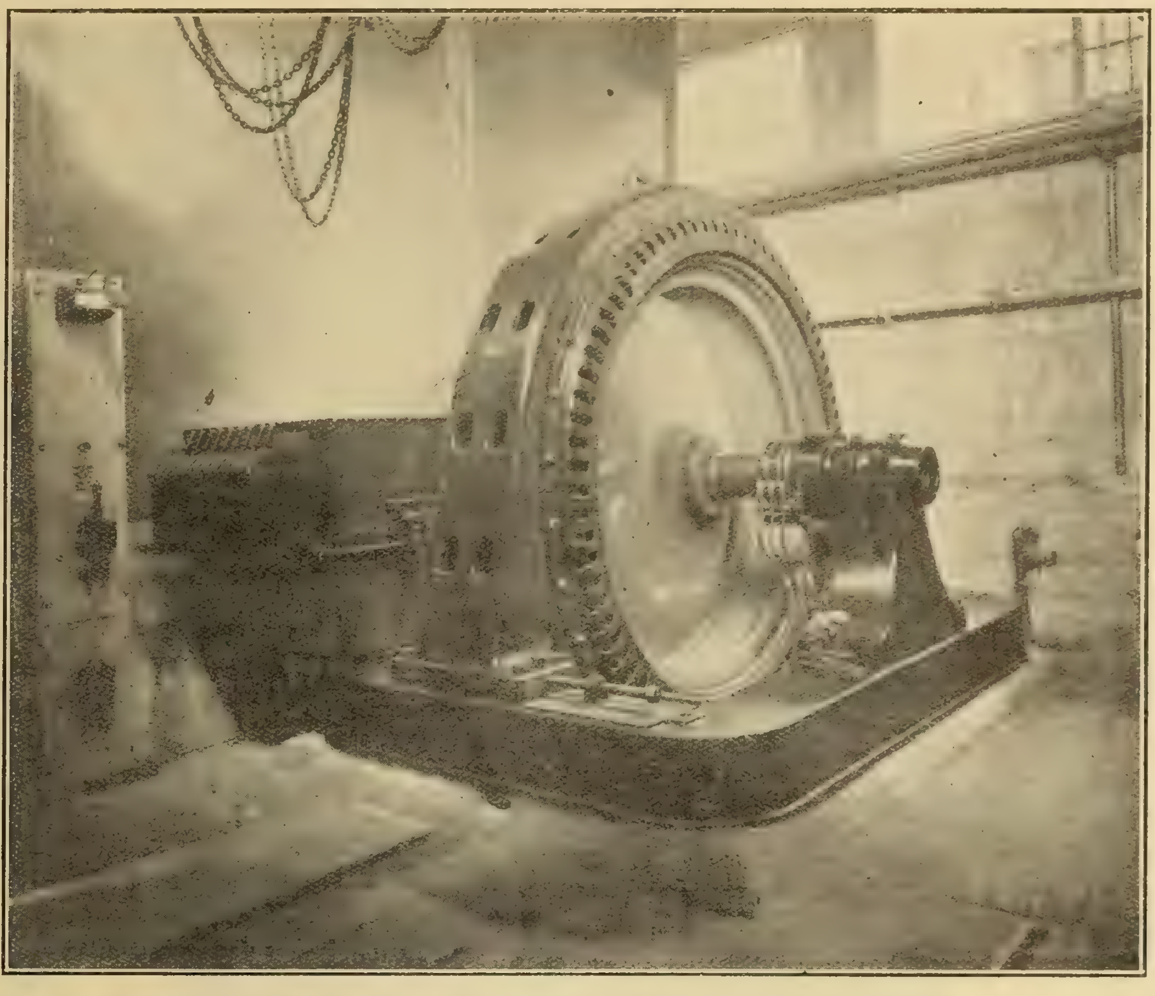
are made according to the specifications of the National Board of Fire Underwriters. The conductors are drawn from copper of the highest conductivity and are covered with two thicknesses of thoroughly vulcanized rubber compound of high quality. The wires are braided over insulation and the smooth high finish they receive makes them specially desirable for conduit work.

IMPERIAL WIRE & CABLE COMPANY Limited MONTREAL

THE Northern-Electric
AND MANUFACTURING CO. LIMITED
SALES AGENTS

TORONTO WINNIPEG
REGINA
CALGARY VANCOUVER

High Grade Electrical Apparatus



1000 H.P. 22000 volt, 3 phase, 60 cycle, 257 R.P.M., induction motor direct connected to pulp grinders at Northumberland Pulp Co., Campbellford, Ont. An extended reference to this plant will be found on another page of this issue.

Kilmer, Pullen & Burnham,

LIMITED

Head Office,
TORONTO

ASEA

Branch Offices: MONTREAL
General Supplies Ltd.,
CALGARY, ALTA.

SOLE DEALERS FOR

The General Electric Co., of Sweden

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The Best Endorsement of the value of the "Electrical News" as an advertising medium is the above List of Advertisers

“GALVADUCT”

The Conduit Used in Canada’s Largest Buildings

“GALVADUCT”

“LORICATED”

The Confederation Life Building, Winnipeg, Man.
A “Galvaduct” Building

Always use “Galvaduct” or “Loricated” Conduit to carry your wiring and get the best protection and service.

If Your Jobber Cannot Supply You, Write Us

Conduits Company Limited

Toronto and Montreal

Do you realize the true significance of a Trade Mark?

It means that the manufacturer of trade marked goods is behind them "all along the line" with his guarantee as to quality.

TRADE DUNCAN MARK

This trade mark insures **"Duncan Quality"** in every electrical specialty or supply that carries it.

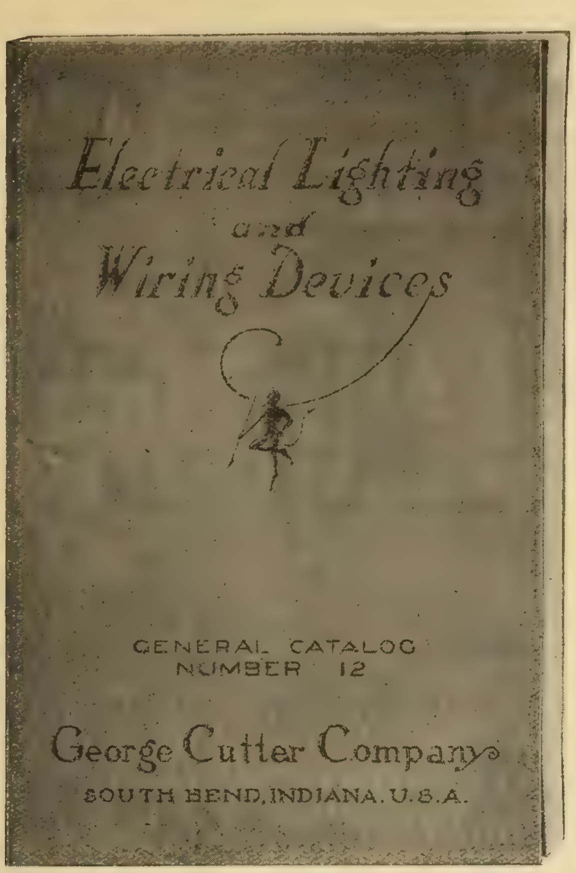
We emphasize it because we want you to be familiar with it and what it stands for—the best materials we can procure and the highest grade workmanship that is possible to employ.

Have you a copy of our NEW catalog?

Duncan Electrical Co.

Limited

Montreal



Electrical Lighting
and
Wiring Devices

GENERAL CATALOG
NUMBER 12

George Cutter Company
SOUTH BEND, INDIANA, U.S.A.

This New "Cutter" Catalog No. 12

Sent free on request

Ask for a copy

You ought to know all about our new lighting and wiring devices and be familiar with the many important improvements in the "Cutter" line of out-door lighting specialties.

You will find this newly published up-to-date 136-page volume convenient for specifying and ordering "Cutter" specialties.

You will also find it helpful for the suggestions and information it gives relative to the use of such devices.

This catalog illustrates and clearly explains the uses of the

New "Cutter" Specialties

Cutout Pulley
New Type Streethoods
Ornamental Lighting Posts
Selflocking Windlasses
Disconnecting Switches
Steel Service and Cutout Boxes
A-W Switch Boxes
Panelboards
Metering Panels
Meter Loop Wire Terminals
Fixture Supports
"Idealite' Industrial Fixtures

Write for the Catalog.

GEORGE CUTTER COMPANY

423 NOTRE DAME ST. SOUTH BEND, IND., U.S.A.

OUR WINNIPEG BRANCH
is successor to
The James Stuart Electric Company
Wholesale Importers and Distributors of
Electric Supplies and Automobile Accessories

The CANADIAN BRITISH ENGINEERING COMPANY
LIMITED

A large and varied stock carried at our Winnipeg warehouse including

- Wires and Cables
- Conduits
- Conduit Fittings and Boxes
- Switches
- Fuses
- Cutouts
- Sockets
- Receptacles, etc.
- Mazda and Carbon Lamps
- Street Light Fittings
- Line Material
- Telephones
- Bells and Fire Alarms
- Dry Cells
- Secondary Batteries
- Heating and Cooking Devices
- Automobile Accessories, etc.

OUR ENDEAVOR

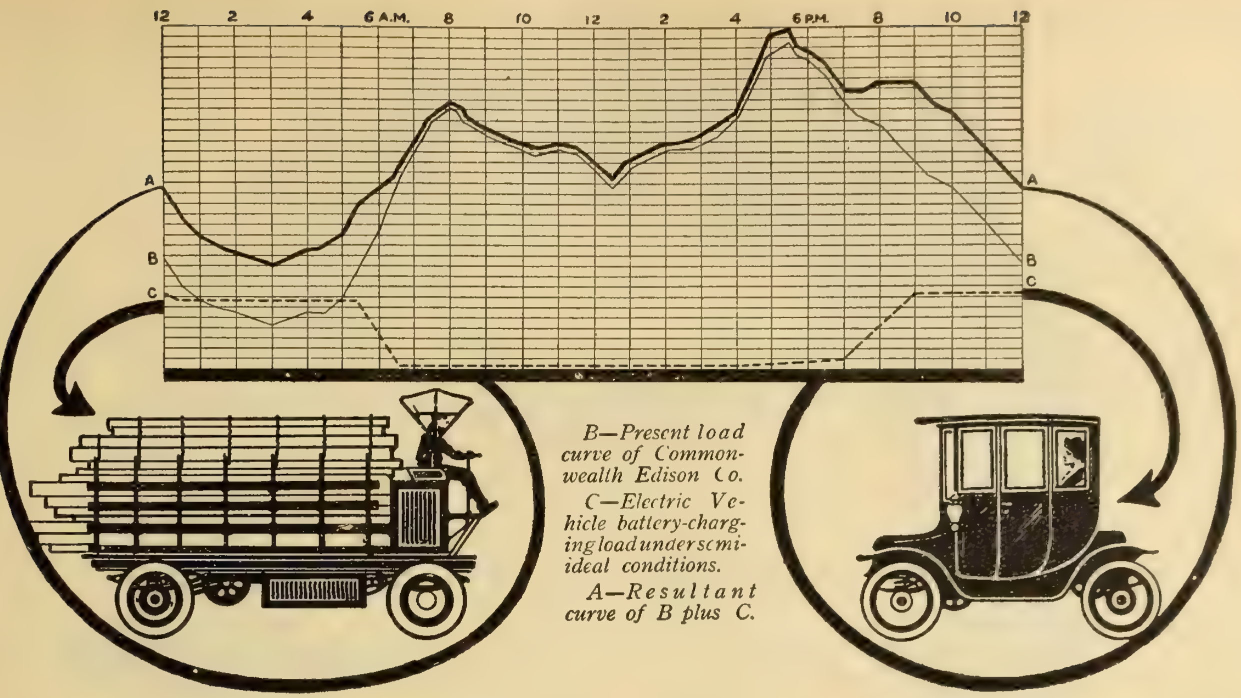
is to ship standard supplies the day order is received

2 Toronto St.
TORONTO, ONT.

327 Smith St.
WINNIPEG, MAN.

847 Beatty St.
VANCOUVER

4 Queen Victoria St.
LONDON, ENG.



B—Present load curve of Commonwealth Edison Co.
C—Electric Vehicle battery-charging load under semi-ideal conditions.
A—Resultant curve of B plus C.

Why Not Make Your Off-Peak Load Count on the Right Side of the Ledger?

18 Mr. Central Station Manager, are you content to let your valley load stay *where* it is and *what* it is—a very expensive feature of the business operation? Why not make your daily off-peak load far more profitable?

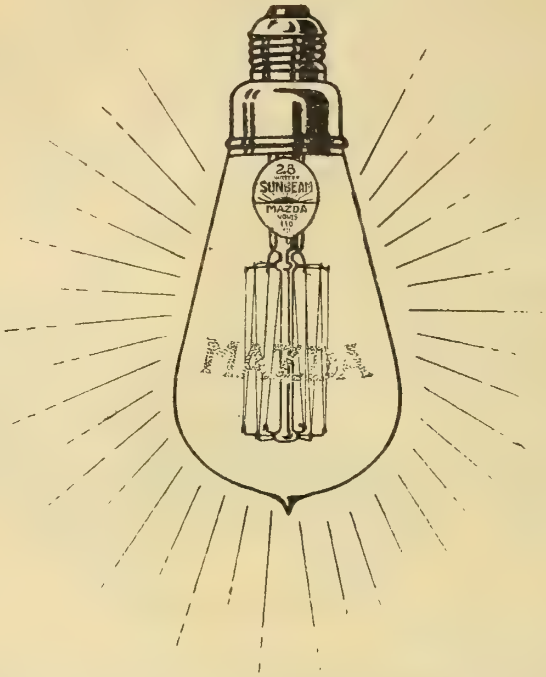
By promoting the sale of Electric Vehicles, you do more than fill-up that non-productive "valley." The current consumption of Electric Vehicles during off-peak time will greatly increase the economical operation of your Central Station *the whole day 'round.*

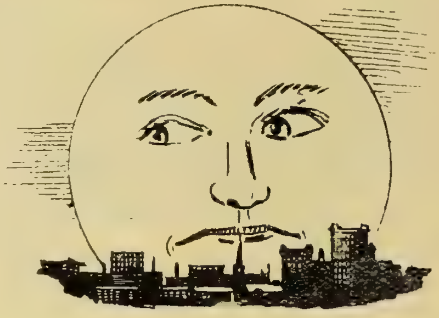
Electric Vehicles Mean Bigger Business For Every Central Station

Every month national magazines and trade journals are carrying the story of the Electric Vehicle—both pleasure and commercial. Many of these people are right in your own territory—legitimate prospects for *you* to work on.

We want your enthusiastic, personal co-operation. We want you to share the benefits of this nation-wide advertising campaign—at very little expense. It will be for our common advantage for you to write us *now* for further information.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA
BOSTON NEW YORK: 124 W. 42nd St. [14] CHICAGO





Rivalled by

Sunbeam Mazda Lamps

IF you wish to win the confidence and continued patronage of your customer sell them "Sunbeam Mazda Lamps" when they want lamps.

A Sunbeam lamp will convert a given amount of electric current into three times as much light as will a carbon lamp.

Such economy means more light for the consumer and increased business for the central station.

Sunbeam Mazda Lamps are made with a patent drawn wire tungsten filament that will stand considerable jar and vibration.

May we send you prices and particulars and dealers' literature?

The Canadian Sunbeam Lamp Company, Limited

Main Office and Factory:
TORONTO

Branch Warehouses:
MONTREAL WINNIPEG CALGARY VANCOUVER

FELT WASHERS

GASKETS - PACKING

Booth saves both time and money for men who want

FELT WASHERS, PACKINGS

or anything else in Mechanical Felt Goods

The time was when the user made these articles himself. But it didn't pay. It took too long to get the felt. It cost too much to make the dies. Machines that were built for something else made awkward business of the work.

So Booth stepped in. He is a specialist in felts. A large part of his factory is packed with them. He designs his own machines. He has shelf upon shelf of interchangeable dies, all made by his own men. The line of round washer dies, for instance, includes every size from 1/8 inch to 24 inches.

The product includes washers, lubricating pads and wicks—gaskets—weatherproofing and insulating strips—oil box packing—felt mats for all kinds of office appliances and other machinery, in fact, everything in felts for mechanical and commercial purposes.

Booth receives an order one day and ships it the next. The bill is rendered for MATERIAL and WORK. It does not include the cost of dies.

THE BOOTH FELT CO., LIMITED

GANANOQUE, ONT.

Use

Moonstone Glass

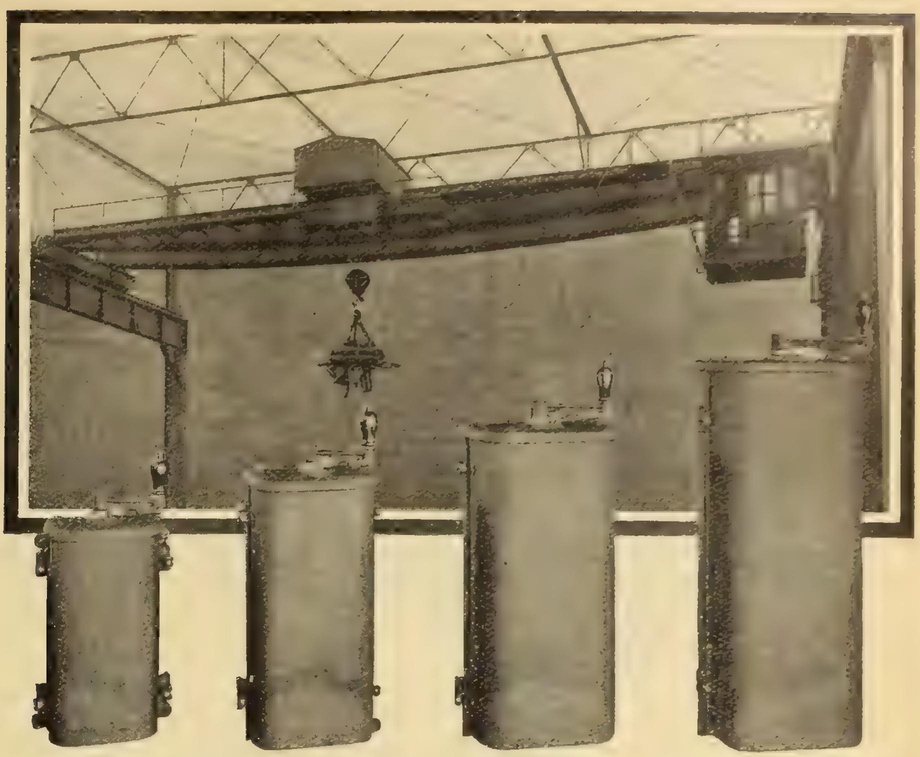
for all kinds of

Illumination

The Jefferson Glass Company
Limited

MADE IN CANADA

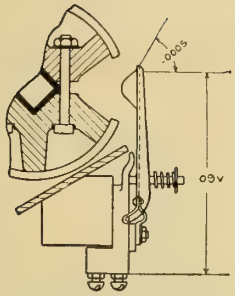
TORONTO CANADA



CUTLER-HAMMER

Drum Type Controllers

Have Been in Service Nearly Two Years



Details of Cutler-Hammer Drum Controller Contacts.

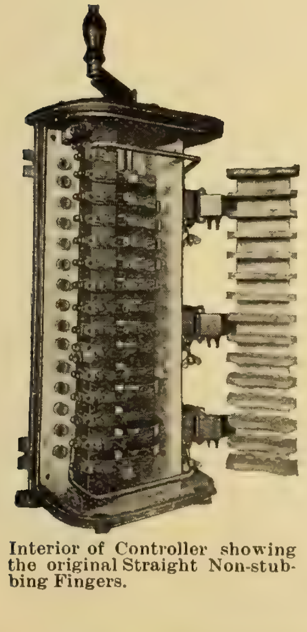
Cutler-Hammer enclosed drum type controllers for crane and hoist service are not new,—they have been in successful service for nearly two years. The success of these controllers has made the enclosed type controller popular.

It is possible to imitate some features of these controllers but there is no copying of Cutler-Hammer experience and specialized engineering service.

Cutler-Hammer engineers have developed all features of the enclosed drum controllers, step by step;—the straight non-stubbing fingers are so designed as to insure smooth uniform contact with the contact segments; the rotary motion is easy and smooth; powerful magnetic fields obtain a blowout on every finger and segment; and the tight fitting drum prevents accidents.

We know the reason for each feature and detail of the controllers because we developed them and the two years in which they have been in service have proven them right.

Cutler-Hammer drum controllers have the original non-stubbing fingers. Bulletins 5300, 5310, 5330, 5340, 5350 and 5360 describe direct current types; Bulletins 9350, 9360 and 9365, alternating current types. Shall we send these to you? Just let us have your address.

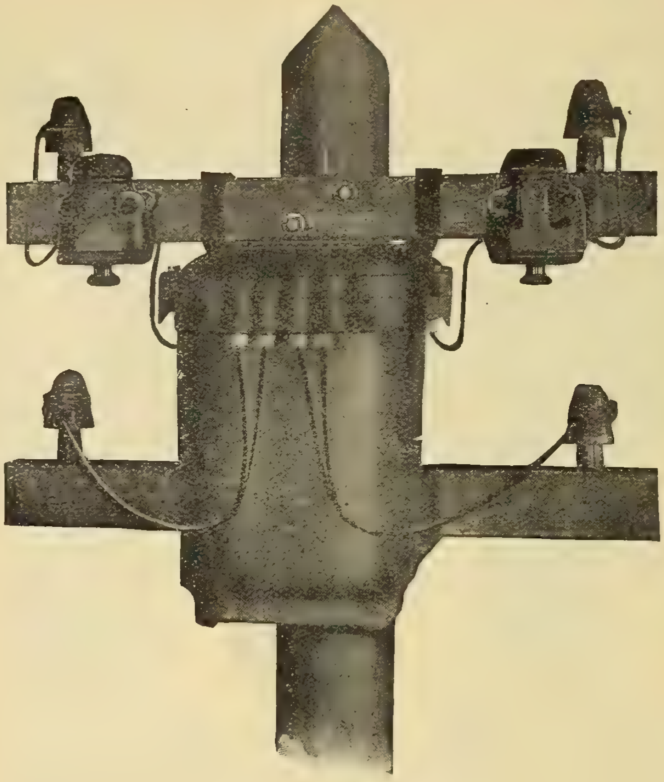


Interior of Controller showing the original Straight Non-stubbing Fingers.

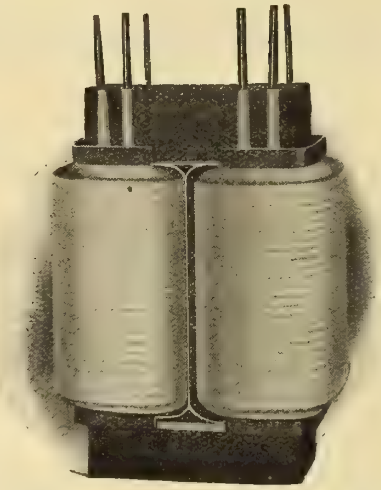
The Cutler-Hammer Mfg. Co.

Milwaukee, Wisconsin

NEW YORK: Hudson Terminal, 50 Church St. CHICAGO: Peoples Gas Bldg.
PITTSBURG: Farmers Bank Building BOSTON: Columbian Life Bldg.
PHILADELPHIA: 1201 Chestnut Street CLEVELAND: Schofield Bldg.
PACIFIC COAST AGENTS: H. B. Squires Co., 579 Howard St., SAN FRANCISCO
229 Sherlock Bldg., PORTLAND, ORE., and W. B. Palmer. 416 E. 3rd St., LOS ANGELES



Moloney High Efficiency Transformer in position on pole showing method of wiring



Interior view of Moloney High Efficiency Transformer

High Commercial Efficiency

is the sum total of what is required in transformers—the knowledge that the current is not being wasted in transformation—that the core and the copper loss is low with a low temperature rise and a high and permanent insulation—that the construction is strong and the workmanship is faultless. All this is necessary and what is required in transformers. All this is what is given in the highest degree in

Moloney
High Efficiency Transformers

Before you decide on the purchase of transformers let us figure out some transformer costs for you. Let us **show you how** Moloney transformers effect a **direct saving** over any other method on account of their high-commercial-all-day-efficiency.

Write for new catalogue giving full data and all information

Canadian Moloney Electric Co., Limited

Office and Works: WINDSOR, ONT.

COMPLETE STOCKS:

WINDSOR WINNIPEG VANCOUVER

The Seven Essentials

which must **all** be present in every **successful** installation of indirect illumination.

(1) Most powerful reflectors *made*
to reflect the largest amount of light generated by the lamp against the ceiling, thus attaining the desired brightness in the illumination of the room at minimum cost for current.

(2) Reflectors of *scientific* design
to direct the light rays against the ceiling at the proper angle so that they will be re-reflected from the ceiling to evenly light the room, and corrugated to prevent streaks on the ceiling.

(3) Reflectors of *lasting* brilliancy
so that the illumination does not become dim with the passing of time on account of the reflecting surface deteriorating.

(4) *Scientific* installation to produce known results
The reflectors must be the proper number of inches below the ceiling, the fixtures must be spaced correctly, the bowls must contain the right type of reflector (concentrating or distributing), etc.

(5) *Natural* seeing conditions for the eye to work by
There must be no visible light sources. No sharp shadows. No direct or reflected glare. No blotchy illumination. No light rays striking the eye directly.

(6) *Low* maintenance cost
Washing of the reflectors must be made unnecessary to save time (Labor cost). Handling of the reflectors and lamps must be reduced to a minimum to save breakage. (Equipment cost).

(7) *Variety* and *Harmony* in fixture design
The interior bowl equipment, i.e., the powerful reflectors, the holders to keep them in the right position with relation to the lamp, etc., must be interchangeable and adjustable to special designed fixtures to harmonize with different interiors.
Before we applied science in perfecting X-RAY reflectors, and their appliances, which embody ALL these essentials, satisfactory Indirect Illumination was impossible. Time has not changed this condition!
These powerful X-RAY reflectors and interior bowl equipment are manufactured exclusively by us and used solely with the

EYE COMFORT SYSTEM
of Indirect Illumination

The most complete and best equipped Engineering Department in the country is always at your service.

National X-Ray Reflector Co.

CHICAGO
214 W. Jackson Blvd.

NEW YORK
505 Fifth Ave.

NEWTYPE BERGMANN LAMPS

(*Tungsten Filament*)

The Unbreakable Kind

Are Now Ready for Delivery

We guarantee delivery to you in good condition

EXCLUSIVE CANADIAN DISTRIBUTORS

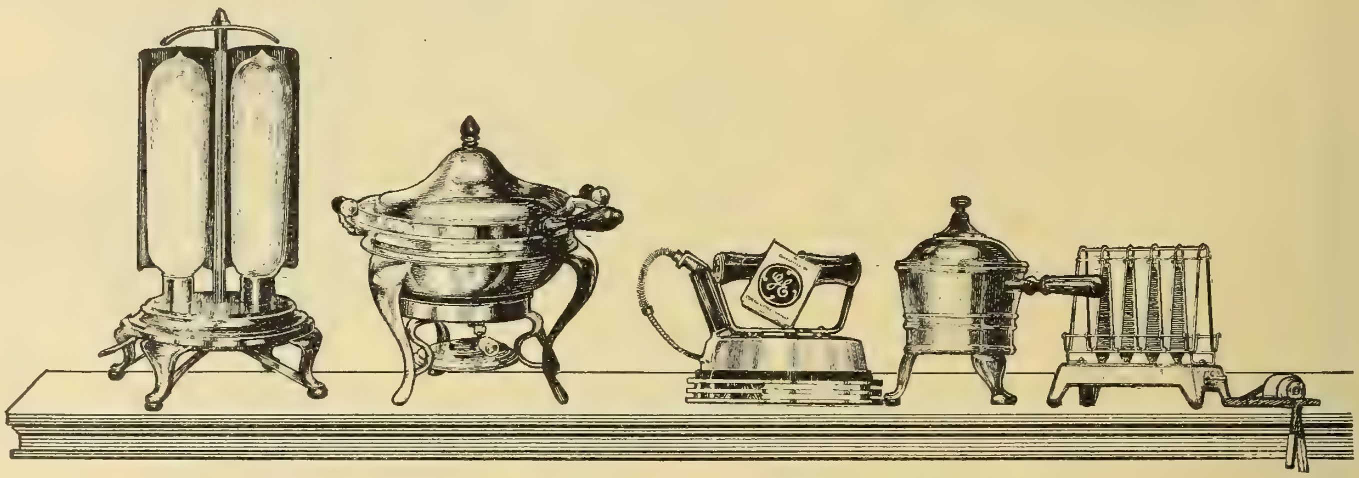
P. H. KLEIN CO.,
LIMITED

329 CRAIG STREET WEST
MONTREAL, P.Q.

LIVE AGENTS WANTED ALL OVER CANADA

Electrical Household

THE NEWEST AND



ELECTRIC Chafing Dishes, Percolators, Flatirons, etc., belong on every dealer's shelves and sooner or later you will have to stock **C.G.E.** devices to keep your best customers from going elsewhere for them.

Begin now, before your customer gets out of the habit of expecting you to carry **C.G.E.** Heating and Cooking Appliances.

It is easy to sell a well-known article of excellence like "The Guaranteed **C.G.E.** Iron" simply by letting the public realize that you handle it and are pushing its sale.

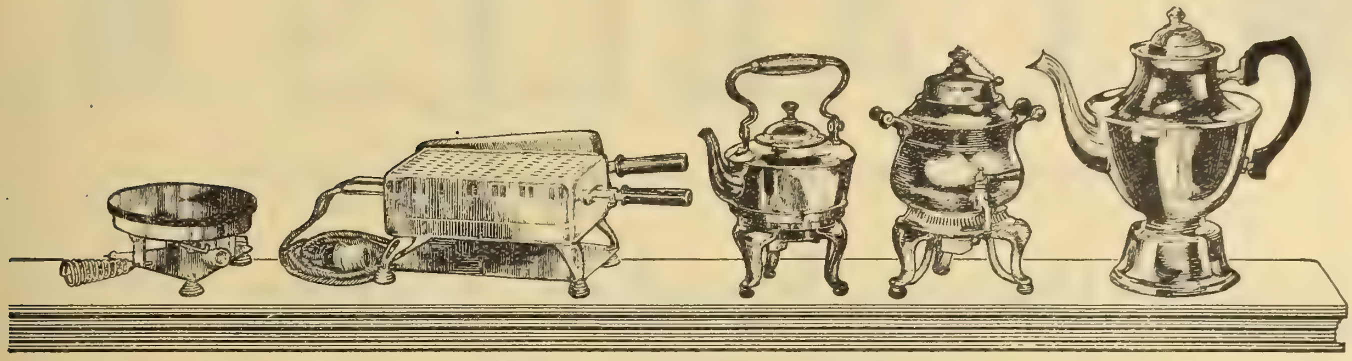
Canadian General Electric Co., Limited

Head Office: TORONTO

Montreal Halifax Ottawa Cobalt Porcupine Winnipeg Regina Saskatoon
Calgary Edmonton Vancouver Victoria Nelson Prince Rupert

Heating and Cooking

MOST PROFITABLE LINE



IF you have never used a **C.G.E.** Toaster, order a sample and take it home, let the family use it every day for a month. Then try to take it back to the store—the chances are you **could not** if you so wished.

From this trial you will get all the talking points needed to sell **C.G.E.** Toasters.

The proof of this Toaster's permanent popularity is **tasting** the toast it makes.

Write Our Nearest District Office for Prices and Descriptive Printed Matter

Canadian General Electric Co., Limited

Head Office: TORONTO

Montreal Halifax Ottawa Cobalt Porcupine Winnipeg Regina Saskatoon
Calgary Edmonton Vancouver Victoria Nelson Prince Rupert

WIRES

and

CABLES

Bare and Insulated in Copper and Aluminum

Railway Feeder Cables
in Copper and Aluminum

Copper Trolley Wire

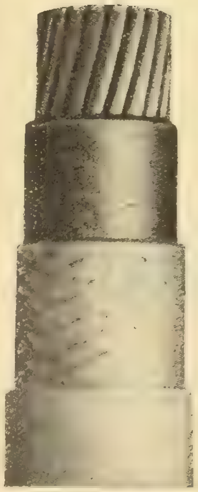
Copper Clad Wire
(Duplex Metals)

Galvanized Steel Strand
Guy Wire

Canada Wire & Cable Co.
Limited
1170 Dundas Street, TORONTO

Stocks of Wire and Cable carried in Toronto, Montreal, and Winnipeg.

SALES AGENTS:
Roper, Clarke & Co. Limited, MONTREAL
A. E. Esling, Scott Block, WINNIPEG
Macdonald, Marpole Co. Limited, VANCOUVER
Messrs. Gorman, Clancy & Grindley, Ltd., CALGARY and EDMONTON



You should stock a full line of Delica White and Lily Tint Lighting Glassware

SHOWING it means *selling* it—every time. The pure whiteness of Delica White and the beautiful green of Lily Tint ***attracts*** customers. The efficiency of the glass under illumination ***holds*** them. You can't find stronger features.

¶ Lily Tint is essentially a domestic glassware. A little intelligent effort on your part—now, when people are renovating their homes for spring—will result in a splendid business. Live merchants all over Canada are realizing this fact. They're ordering *their* stocks.

¶ Shall we bring photographs to you.

The Pittsburgh Lamp, Brass & Glass Co., of Canada, Ltd.

113 Wortley Road,
LONDON, ONTARIO

PILABRASCO

R. E. DAVIS
Special Representative

The West's Greatest Electrical Supply House

Ornamental Lighting Standards

Manufactured by the King Foundry Co., St. Josephs, Mich.

Latest Designs Excellent Finish

The "Century Single Phase Motors"

Adaptable to 110 and 220 Volt

Hundreds in use in Western Canada and everyone giving satisfaction. They take care of the small power requirements perfectly

The Famous "THOR" and "RED ELECTRIC"

Hurley Washing Machines

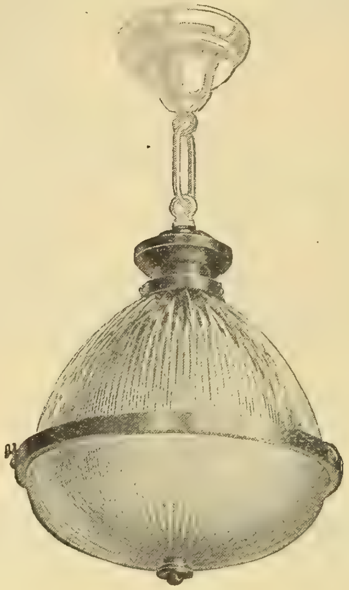
Over twenty thousand giving satisfaction in twenty thousand homes

"Appleton" Unilets

The latest improved conduit fitting, made in all styles for all purposes. Once acquainted with these fittings, and you use them always. They are roomy and save time. Complete stock always on hand.

The Mainer Electric Company, Limited

Winnipeg, Man.



ALL SIZES
25 TO 500 WATTS

Don't overlook the greatest lighting unit of the day

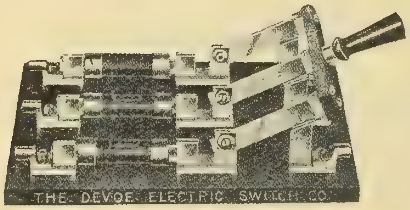
The Holophane Realite

All details upon request

The Holophane Co., Limited
60 Front St. West, TORONTO

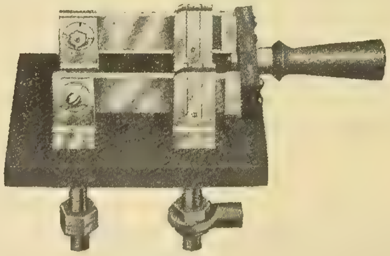
The Devoe Electric Switch Company

Manufacturers of
Switches, Switchboards, Panelboards, Iron Boxes and Cabinets



Cut No. 343

An examination of "DEVOE" Standard Panels, Switches and Switchboards will convince you they are the best made.



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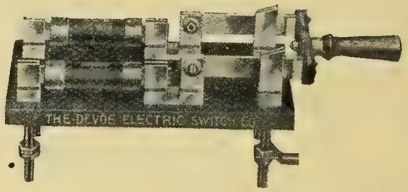
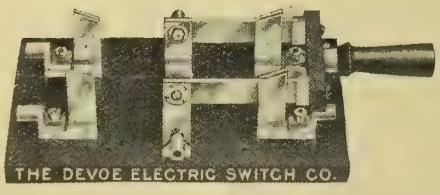


Cut No. 2005

Every "DEVOE" product is built for efficient service under actual operating conditions.



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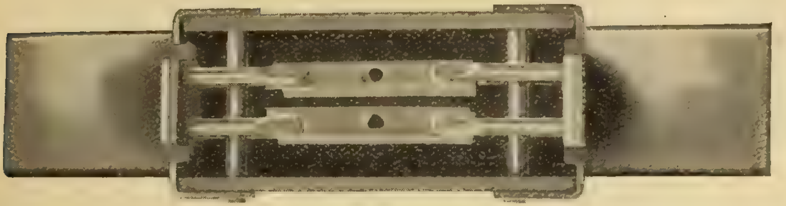
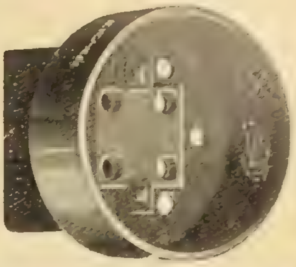
OFFICE and FACTORY, 157 Craig St. West, MONTREAL

Fuse Troubles Permanently Overcome



These Cuts
Show the
"NOARK"
Construction
of Enclosed
Fuses



If you are having constant trouble on your circuits from fuses blowing out without apparent cause, it is time you took up the question of using

"NOARK" Enclosed Fuses

These fuses are used exclusively by the largest Electric Light and Power Companies, Telephone Telegraph, Fire Alarm and Railway Companies, because "NOARK" Enclosed Fuses have proven to their entire satisfaction to be the most reliable fuses for inside, exposed, underground and aerial service.

Get in touch with our nearest Branch TODAY. Ask for our Fuse Booklet.

The Canadian H. W. Johns-Manville Company, Limited

Manufacturers of Asbestos and Magnesia Products

ASBESTOS

Asbestos Roofings, Packings, Electrical Supplies, Etc.

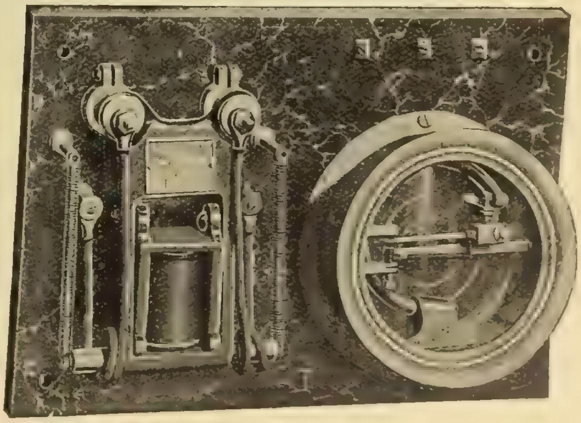
1501

TORONTO MONTREAL WINNIPEG VANCOUVER

Perfect Pressure Control

Can be obtained in tanks and reservoirs by starting and stopping the motor driven apparatus with

THE SUNDH GAUGE TYPE REGULATOR



The simplest, strongest and most satisfactory regulator made. Operates on a pressure difference of 3 to 5 per cent. of maximum pressure. Wider range may be obtained by screwing down the left hand screw.

The construction consists of a silver-tipped contact lever attached to the tube and moving between two silver contact points on pressure fluctuations.

The screw on the right is used for adjusting to maximum pressure desired, and the lower screw on left hand is for adjusting for difference in pressure.

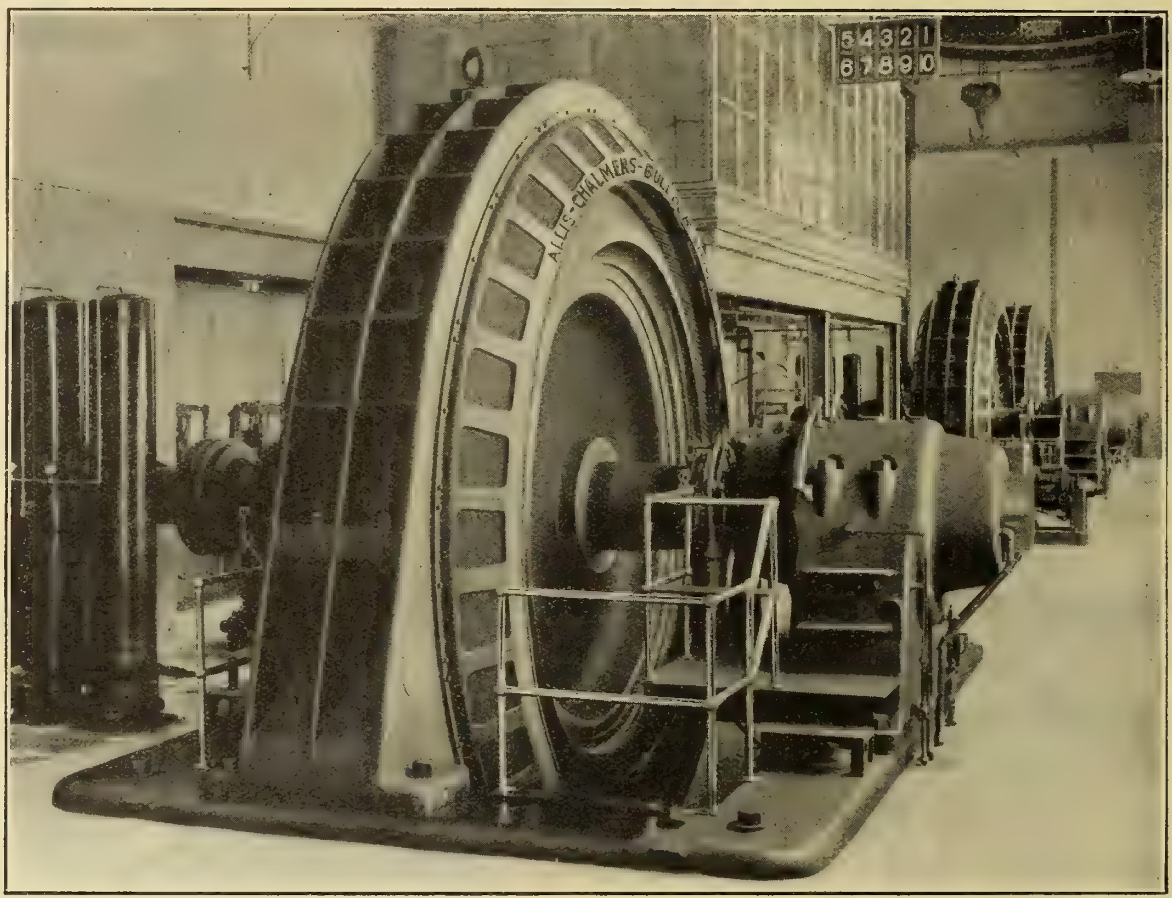
Send for "Sundh" catalogue giving complete description of controlling devices for A.C. & D.C.

SUNDH ELECTRIC CO., - - - NEW YORK, U.S.A.

Represented by C. H. L. Keeler Co., Ltd., Toronto, Canada

WATER WHEEL TYPE OF

GENERATORS



3 Alternators each 5,000 K. V. A. 60 Cycle, 3 Phase

in the St. Timothee Power House of

The Canadian Light and Power Co.

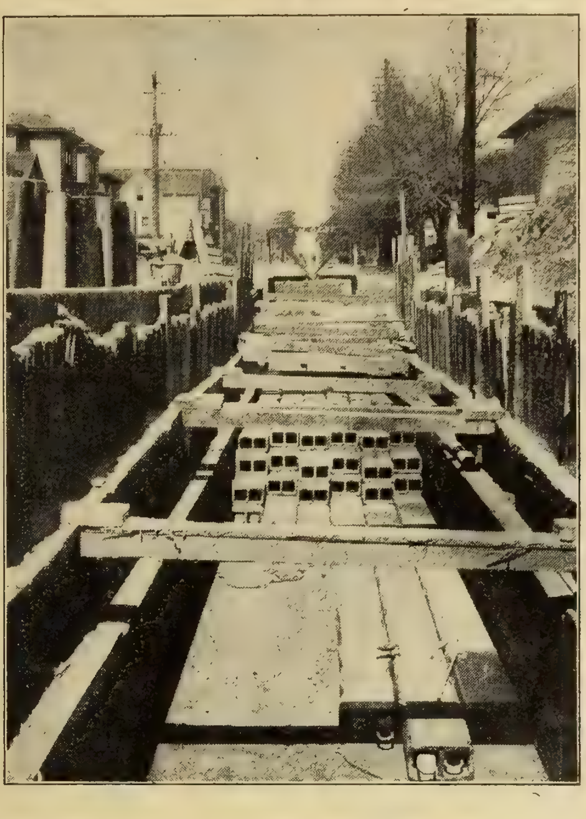
built by

ALLIS-CHALMERS-BULLOCK
LIMITED

WORKS - - - MONTREAL

Sales Offices: MONTREAL, 613 Canadian Express Co. Bldg. TORONTO, 810 Traders Bank Bldg.
WINNIPEG 601 Builders Exchange Bldg. VANCOUVER, Dominion Bldg.
COBALT CALGARY

G. M. GEST Conduit Engineer and Contractor



Electrical Underground Conduit Systems

When **G. M. GEST** designs and constructs your Conduit System you receive the benefit of many years' experience and specializing in that line of work.

Power Building, Montreal, P.Q.

Crocker-Wheeler Transformers

A. C.
Induction
Motors
Generators
Transformers

D. C.
Motors
for all
classes
of work
Generators

A full stock of standard voltage distributing transformers in sizes 1 to 50 K.V.A. 60 to 25 cycle is on hand for immediate shipment.
Communicate with us regarding your Fall and Winter requirements.

The Canadian Crocker-Wheeler Co., Ltd.

Manufacturers and Electrical Engineers

Head Office and Works:
ST. CATHARINES, ONT.

Branch Offices:
MONTREAL TORONTO VANCOUVER

HERE IT IS

12 Volt Nulite---5 Watt

Drawn Wire Continuous Filament

Tungsten Sign Lamp

Mr. Advertiser, would you insert an "ad" in the newspaper with instructions to have it smeared over and made undecipherable?

YOU ARE DOING THIS

if you still use carbon lamps to light your sign, only in a more noticeable way.

THINK THIS OVER

Your sign will attract attention, as it should, when equipped with **Nulite** tungsten sign lamps, and effect a saving of ½ to ¾ on its operating cost over the old way—can you continue to let it cost you three times more and not give you any returns?

"ACT"

Change now, it will pay for itself within a few months, and still continue to give you perfect service and draw the public's eye to your location.

"NULITE"

Is the name—remember it—and insist on having your sign fitted with them.

MANUFACTURED BY

The Canadian Tungsten Lamp Co., Ltd.

Hamilton - Ont.

Branches at—
Montreal—246 Craig St. W.
Winnipeg—56 Albert St.
Vancouver—365 Water St.

Agencies—
St. John, N. B.—T. McAvity & Sons
Halifax, N. S.—Farquhar Bros,, Limited
Quebec, Que.—Mechanics Supply Co., Limited
Toronto, Ont.—Dominion Illuminating Rental Co.

No more of this

Many factories, mills, hotels and railroads have deferred the installation of high efficiency lamps, because their own employees would take the lamps home with them or trade them for a drink over some nearby bar.

Many plants have tried to protect these high efficiency lamps by adopting a special etching to show that the lamps were stolen. This expensive etching can be done away with, and high efficiency lamps freely installed with absolute protection against theft by use of the

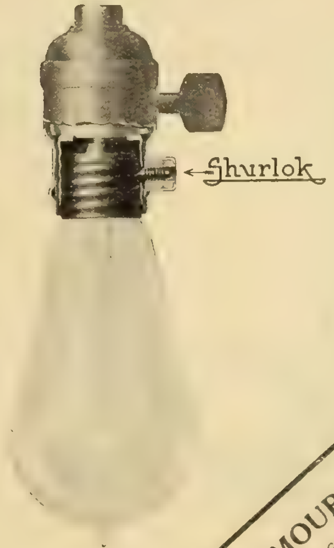
Shurlok

The socket that locks

For sale by all jobbers but carried in stock by

John Starr, Son & Co., Limited	Halifax
St. John Railway Company	St. John N. B.
Mechanics Supply Company, Limited	Quebec
Dawson & Company, Limited	Montreal
Central Electric & School Supply Company	Toronto
Mainer Electric Company	Winnipeg
Dawson & Company	Winnipeg
General Supplies Limited	Calgary, Alta.
Cope & Son	Vancouver

Lamps can be released only by the special master key—and we sell the keys only to those properly entitled to have them.



For Free Booklet use the Coupon

Pass & Seymour, Inc.

Main Office and Works: **SOLVAY, NEW YORK, U. S. A.**

New York City, 178 Fulton Street
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PASS & SEYMOUR, INC., Solvay, N. Y.
Please send free copy Shurlok Booklet and Catalog 20.
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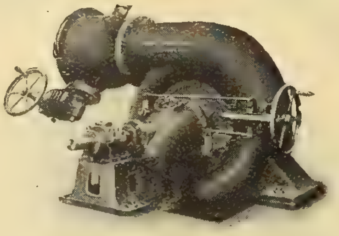
Water Power Plant



Type 30 Francis Turbine
1000 B.H.P. 120 Feet Fall

As supplied to Ocean Falls Pulp and Paper Co., Dryden Timber and Power Co. Expert advice at your immediate disposal for estimating purposes, etc.

James Gordon & Company

81 and 83 Knightrider Street, LONDON, ENGLAND.

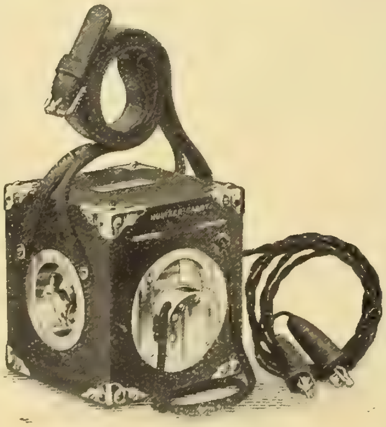
Sole Canadian Agents

Chapman & Walker, Ltd.

116-118 Richmond Street West, TORONTO

Holtzer-Cabot

Power Transmission Line Patrolman's Portable Phone



Weight only 6½ lbs.
Dimensions only 5" x 5" x 5½"

Strong and Durable.
Corners Dovetailed and reinforced.
Receiver-Transmitter and Crank practically flush with the case.
Equipped with cord, Williams test clips and carrying strap as shown.

Send for Bulletin No. 402

The Holtzer-Cabot Electric Co.
Chicago, Ill. Brookline, Mass.

"STANDARD" Steel Tape Armored Cable

You can save about one-half

in single runs of cable by using "Standard" Steel Tape Armored Cable laid directly in the ground, instead of the usual lead-covered cable installed in clay conduits.

The steel tape, while of course, not affording the same protection to the conductors as clay duct encased in concrete, is ample for the purpose. This is proven by the many thousand of feet of "Standard" Steel Tape Armored Cable which has been giving satisfactory service for years.

"STANDARD" Steel Tape Armored Cable

is protected against mechanical injury by a cushion of tarred jute over the lead sheath, upon which two layers of heavy steel tape are wound helically, the second layer covering the openings between the convolutions of the first. Over this is wound another coating of tarred jute.

For ornamental lighting systems, where low first cost and durable construction are required, it is especially satisfactory and economical. It is also applicable to many other low tension underground distributing systems such as in mill and factory yards, through parks and for certain classes of marine service.

For prices and further information address our nearest office.

Standard Underground Cable Co. of Canada, Limited

Hamilton, Ont.

Montreal, Que. Winnipeg, Man.
Boston, Mass. Seattle, Wash.

Manufacturers of Electric Wires and Cables of all kinds, for all services, also Cable Accessories, etc.

REMOVAL NOTICE

¶ We have the pleasure in announcing that we have removed to our new building

116-118 Richmond Street West,
TORONTO

¶ We take this opportunity of thanking our many friends for the business which has made these larger premises necessary and trust that with larger stock and better facilities we may merit a greater share of your patronage in the future.

CHAPMAN & WALKER, Limited
TORONTO, CANADA

Protection from Lightning Troubles

The following list of users of the Mosciki System of Lightning Protection speaks for itself:

- Victoria Falls and Transval Power Co.
- Shanghai Municipality.
- Melbourne Electric Supply Co.
- Cleveland and Durham Power Co.
- St. John Del. Key Co., Brazil.
- Societa Dergano.
- Sociedad Espanola, Madrid.
- Societa Electrica Suburbana, Milan. &c.

(MOSCIKI SYSTEM)

Lightning, if unchecked, will break the windings of your apparatus, blow out your fuses and break down your transformers.

In short, lack of adequate and capable lightning protection may mean to you serious loss of time, money, and perhaps lives.

A host of so-called lightning arresters are on the market, but 99 per cent. of them are valueless because the principle on which they are constructed is wrong.

High frequency—not high voltage—is the cause of the damage done by lightning.

Most protective systems work on the principle that high voltage is the cause of the damage. This is incorrect, hence their uselessness.

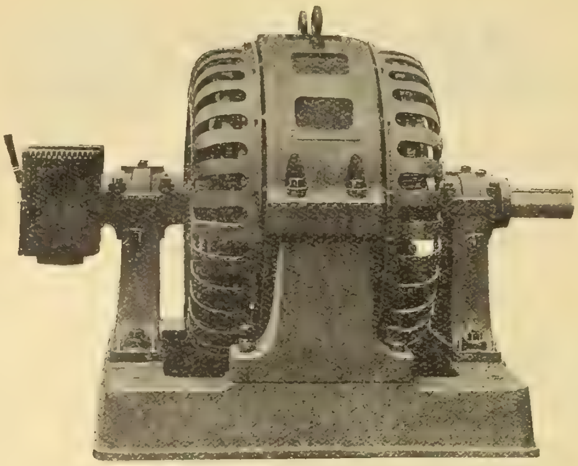
A lightning protection apparatus to be of any use **must offer a clear path to earth for high frequency currents independent of voltage.**

The MOSCIKI System of Lightning Protection fulfills this condition absolutely—it's principle is correct—its design the best and its guarantee absolute. Write us for fuller particulars.

Mosciki Lightning Arrester

Exclusive Canadian Agents

CHAPMAN & WALKER, ELECTRICAL ENGINEERS AND CONTRACTORS
116-118 Richmond Street W., TORONTO



PHOENIX DYNAMO MFG. CO.
BRADFORD - ENGLAND

DYNAMOS
and
MOTORS

Canadian Agents :

Federal Engineering Co.
Limited

TORONTO MONTREAL WINNIPEG VANCOUVER

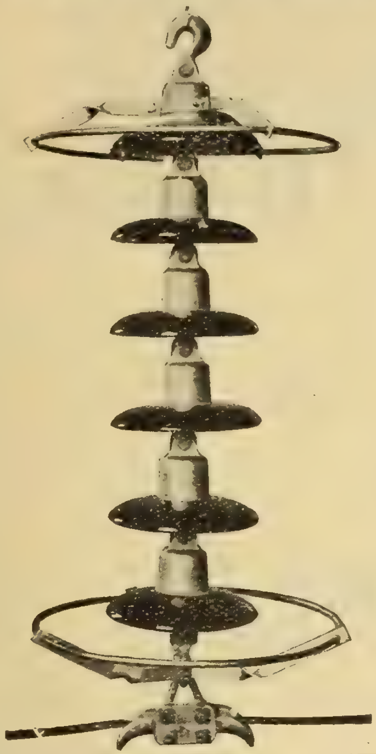
Sale of Fittings

Condulets from 2 inches down to one-half inch.
V. V. Fittings from 2½ inches to 1½ inches.
Various sized locknuts, boxes, both shallow and deep.
Panel boxes, knife switches.
Some No. 6 Weatherproof Wire, No. 4 Weatherproof Wire, 70 feet of 800,000 C.M. Rubber covered Double Braid Cable, a few Stocks and Guides.

All of the above is material left on our hands after completing work in which we were engaged. For anybody who could use these, we would be willing to make an attractive offer. It would pay you to look into this. Send for list.

Federal Engineering Co., Limited
Toronto, Ontario
90 Sherbourne St.

Nicholson Arcing Rings



Insulator designers a few years ago sought to obtain the greatest flashover voltage test per unit cost; today we are getting away from that type as rapidly as possible—we want maximum electrical (puncture) strength, preferring less size of insulator if necessary.

Arcing rings **relieve** the insulator during over-stresses. They reduce the **dry,** flashover voltage, but do not reduce the **wet** flashover voltage. The resistance of the surface is **not** reduced, but immediately the arc has formed over the surface it is taken by the rings instead of by the line wire and pin.

Arcing rings are valuable because—

1. They relieve the insulator of over-stresses, thereby avoiding punctures.
2. They prevent destruction of insulators by the heat of an arc.
3. They prevent the arc burning the line cable.

The Locke Insulator Mfg. Co.

OR

Engineering Equipment & Supply Co.
410 St. James St., Montreal, Que.

The "Stave-Arco" Flaming-Arc-Lamp

The Last Word on Flame Lamps

Guaranteed 100 hours per trim
Economy of Operation
Highest Efficiency
Highest Candle-Power

The Lamp for Outdoors as well as Indoors

—ALSO—

Locke High Tension Insulators
Line—Construction—Materials
Central Station Apparatus
Power and Lighting Supplies
Overhead Railway Materials

Write Us

Engineering Equipment & Supply Co.

410 St. James St. - Montreal
Telephones: Main 2242--2243

"Banner"

TRADE MARK

Lighting Fixtures

Write to us for the latest designs in "up-to-date" electric fixtures.

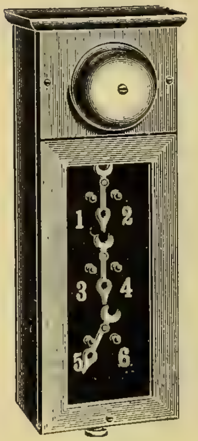
Fixtures made from original drawings on short notice.

Ontario Lantern & Lamp Co., Limited,
HAMILTON, CANADA.

Agents for "Sterling" British Made Telephones, Bells, Annunciators

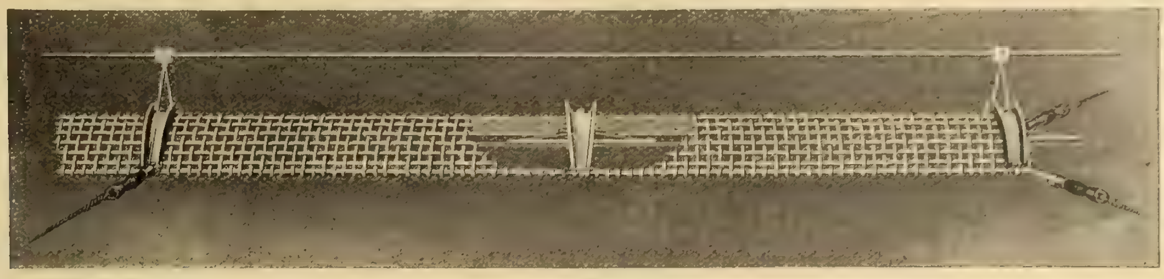
MANITOBA.—The Can.-Brit. Eng. Co., Ltd.
324 Smith Street, Winnipeg
ONTARIO.—Chapman & Walker, Ltd.
116-118 Richmond St. W., Toronto
SASKATCHEWAN—The Northwestern Electric Ltd.
Scarth Street, Regina
BRITISH COLUMBIA.—Cope & Son Ltd.
Water Street, Vancouver
ALBERTA.—General Supplies Ltd,
122 Eleventh Ave. W., Calgary

QUEBEC.—Stocks kept by:-Dawson & Co., Ltd., Montreal. Mechanics Supply Co., St. Paul, Quebec.
NOVA SCOTIA.—Stocks kept by:—John Starr, Son & Co. Ltd., Halifax.
NEW BRUNSWICK. St. John Railway, Dock Street.



No. C. 6178 Needle-drop Annunciator
English Manufacture

STERLING TELEPHONES
BRITISH MADE



NATIONAL RAILROAD TROLLEY GUARD

Minimizes chances of cars being stalled at grade crossings because of trolley wheel leaving wire.

Light in weight. Open mesh offers little resistance to exhaust from locomotives or heavy wind; prevents collecting of snow or ice.

Easily installed and requires little maintenance. One large road reports that their guard has been up for over three years and they have not had to spend a cent for maintenance.

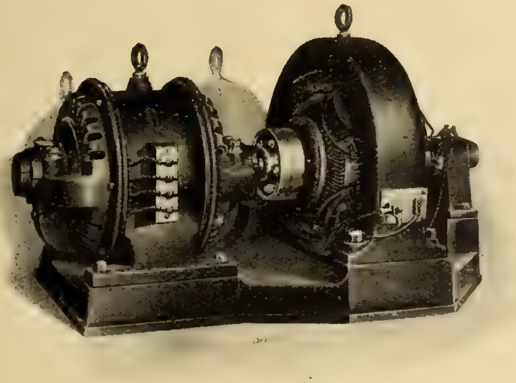
Over 75,000 feet in service on 150 prominent roads.

Full description and listing given on pages 174-176 of Catalog No. 12.

THE OHIO BRASS COMPANY, Mansfield, Ohio, U. S. A.

Toronto & Hamilton Electric Company

HAMILTON



Make

Motors for all circuits

Dynamos for power and light and electroplating.

Repairs executed neatly and promptly.

Write us.

Special Prices on Electrical Books

The Following Books are Offered Subject to Previous Sale

The Steam Turbine, by Robert M. Neilson. Published in 1903 by Longmans, Green & Co., 294 pages, illustrated. Price $1.00.

Telegraphy, bp Sir W. H. Preece, K.C.B., and Sir J. Sivewright, M.A. Published in 1905 by Longmans, Green & Co., 504 pages. Price $1.00.

Electro-Dynamos, by Charles Ashley Carus-Wilson. Published in 1898 by Longmans, Green & Company. 298 pages, Price 50c.

Elementary Lessons in Electricity and Magnetism, by Silvanus P. Thompson. Published in 1895 by MacMillan & Company, 628 pages, illustrated. Price 50c.

Electric Lighting & Heating, by Sydney F. Walker, Published in 1907 by Norman W. Henley Publishing Company. 438 pages, illustrated. Price $1.00.

Dynamo-Electric Machinery, by Francis B. Crocker, E.M., Ph.D. Published in 1908 by American School of Correspondence. 236 pages, illustrated. Price $1.00.

Telephone Law, by A. H. McMillan. Published in 1908 by McGraw Publishing Company. 332 pages. Price $1.50.

Explanations of Switch and Signal Circuits. Published in 1907 by Doran & Kasner. 140 pages. Price 40c.

Practical Methods of Electro-Chemistry, by F. M. Perkin, Ph.D. Published in 1905. 322 pages. Price $1.00.

Treatise on Thermodynamics, by Dr. Max. Planck. Published in 1903. 272 pages. Price $1.00.

Text-Book of Electrochemistry, by Svante Arrhenius. Published in 1902. 344 pages, illustrated. Price $1.00.

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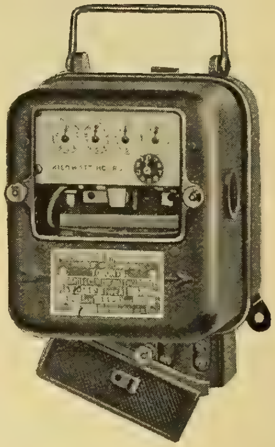

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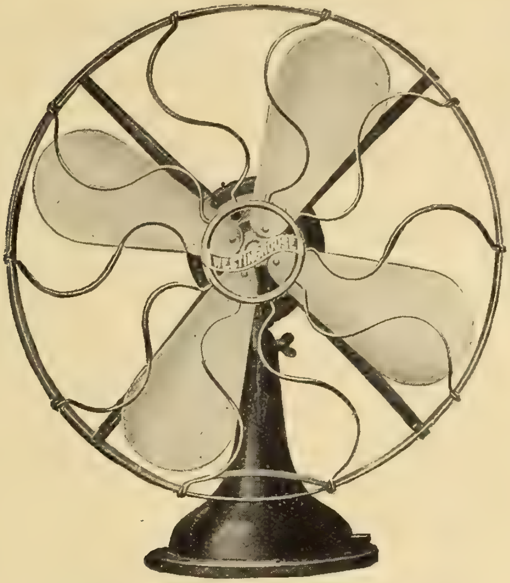

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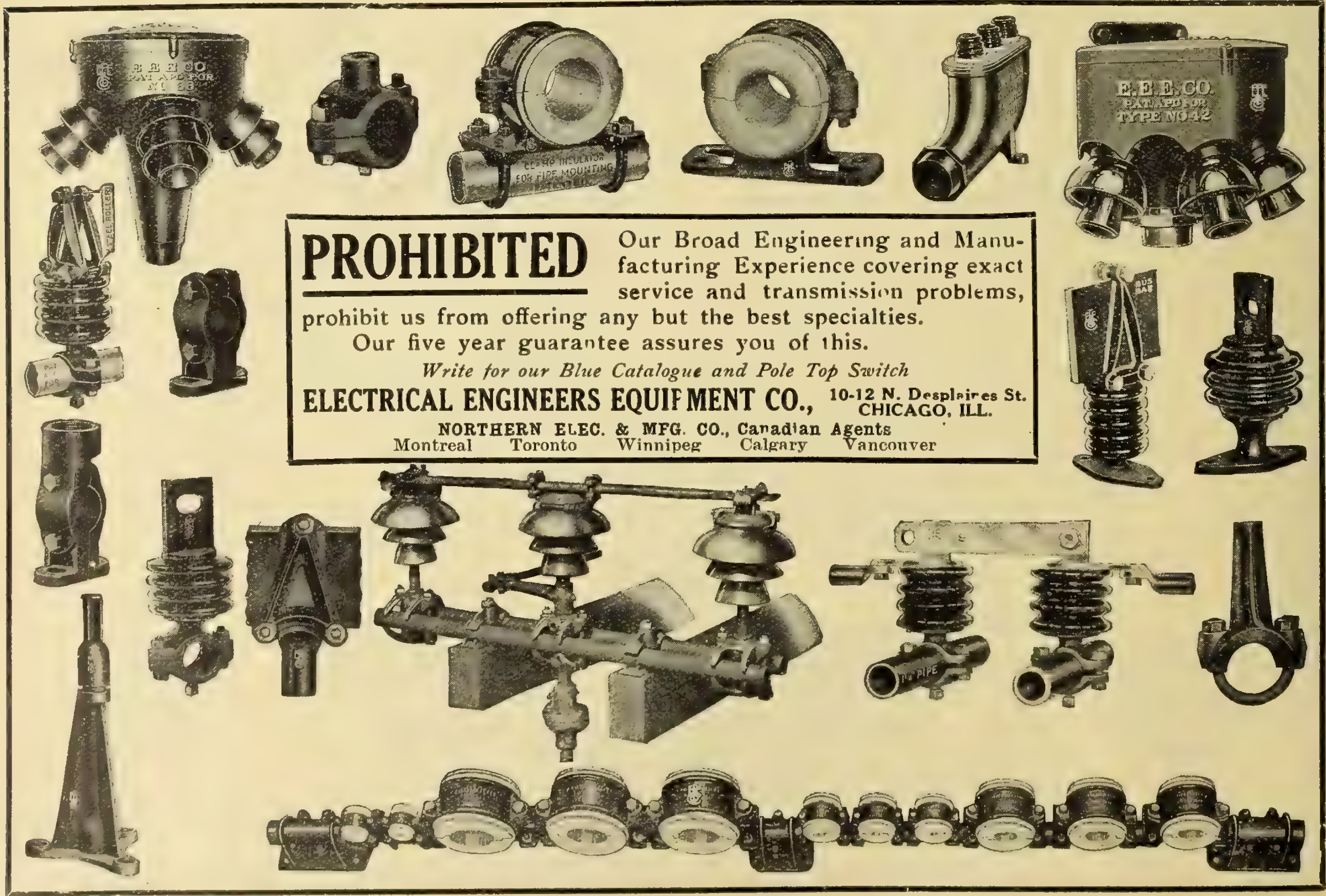
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Electrical News

Generation, Transmission and Application of Electricity

PUBLISHED SEMI-MONTHLY BY

HUGH C. MACLEAN, LIMITED,

HUGH C. MacLEAN, Winnipeg, President.
THOMAS S. YOUNG, General Manager.

HEAD OFFICE - - 220 King Street West, TORONTO
Telephone Main 2362

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WINNIPEG - Telephone Garry 856 - 404 Travellers' Bldg.
VANCOUVER - Tel. Seymour 2013 - Hutchison Block
NEW YORK - Tel. 3108 Beekman - 931 Tribune Building
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Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Vol. 22 Toronto, April 1, 1913 No. 7

Electric Lines as Local Improvement

The suggestion has been brought forward in Toronto that the payment for future civic car extensions should be made on the local improvement plan. Arguments in favor of this scheme are contained in a report just made to council by the chairman of the transportation committee, Ald. Dr. Wickett, by whom this plan, as applied to Toronto, has been introduced. The report quotes the opinions of engineers in Boston and New York in favor of this system, and also in the city of Schoeneberg, Germany, where a precedent for its application has been established.

At first flush the objection was naturally raised that this would open the way for a certain amount of scheming and wire-pulling by different sections of the city to have lines serve their property, but it is pointed out emphatically in the report, and we understand the intention of the transportation committee to be very decided in this matter, that any extension whatever must be a part of a general, comprehensive scheme of railway development which will be worked out and adopted by the city before this plan of extension is placed in operation at all.

The scheme has much to recommend it in principle, as the advantages and improvements introduced by a street railway compare in many respects with those of other local improvements such as sewers, good roads, water, etc. There is no doubt that all these improvements are alike in enhancing values of land in the section served. It is also a fact that the introduction of improvements into any new section tends to depreciate property in other sections, thus emphasizing the injustice to the general taxpayer of assessing him for improvements in any one section.

The system of assessment, however, is something that would have to be worked out with extreme care. A sewer benefits the street along which it runs, or a trunk sewer benefits uniformly the section it serves, but a street railway will benefit one part of a section more than another. If it is a residential section the land along which the railway runs will not in general increase in value to the same extent as land a little farther removed. In a business section, again, the reverse would generally be true, and it would need a very thorough knowledge of conditions, present and future, to determine these points. Again, it would appear that a section of railway nearer the centre of the city, in that it also serves the sections beyond, should in some measure at least, be paid for by those outlying sections.

Another difficulty seems to lie in the duplication of roads by municipalities and private companies. For example, the city's plan may mean the construction of a road through a section already served or soon to be served by a private line. In this case the local road would not carry the same advantages to the neighborhood it passes through and there would seem to be an injustice in assessing the land owners in that district on the plea of an increase in values which might have taken place from another cause entirely. This, again, would raise a very nice point in the adjustment of assessments.

It must be said, however, that the scheme is one which will appeal almost unanimously to the citizens living or owning land in the outskirts of the city of Toronto. There is very urgent need for railway extensions. The city and the local railway company do not appear to be able to co-operate and this solution of the difficulty would probably give the outlying districts railway service with less delay than any other plan that could be brought forward.

Water Powers of British Columbia

The Minister of the Department of Lands of British Columbia, Hon. W. R. Ross, who has jurisdiction over the waters of that province has just issued his annual report for the year ending December 31, 1912. The report contains results on progress made to that date on investigations of certain water powers including the Columbia, the Kootenay and smaller rivers and though covering only a small section indicates the great power possibilities of this province. Two sections of the Columbia river were covered (a) from the international boundary to Castlegar and (b) the Big Bend from Kinbasket Lake to Goldstream. There are no water power possibilities under (a) in the main river, but tributaries to this river showed a number of falls of appreciable size. On Cummins Creek which rises in the Rocky Mountains there is an average fall of 180 ft. per mile as far back as the river was followed with indications that 4,300 h.p. could be developed. Goose Grass Creek rising in the Selkirks averaged 520 ft. per mile for 2½ miles back from the source. Yellow Creek rising in the Selkirks was followed for 9 miles and showed falls as great as 736 ft. with an average of 500 ft. per mile. Wood River rises in the Rocky mountains and has a fall of 278 ft. Harvey Creek rising in the Rockies averages 245 ft. fall per mile for the first 2½ miles. Boulder Creek showed a fall of 330 ft. during the first mile. Soard Creek has an average fall of 350 ft. for the first mile. Gold Stream rising in the Selkirks and emptying into the Columbia 55 miles north of Revelstoke averages 160 ft. fall per mile for some distance back with more falls reported but not reached. Smith Creek rising in the Gold range showed an average fall of 250 ft. per mile as far as followed.

Kootenay River

The Kootenay River was investigated from its junction with the Columbia at Castlegar to a point about 6 miles from Nelson covering a distance of 18 miles. The total fall throughout that distance is 330 ft. and the discharges from

10,000 to 12,000 second-feet. The power possibilities include Upper Bonnington Falls already appropriated by the West Kootenay Power & Light Company and the City of Nelson, (b) the Lower Bonnington Falls utilized by the West Kootenay Power & Light Company, (c) a series of falls above Bonnington pool, giving a 77 ft. drop on a length of 3,200 ft. This will develop over 40,000 h.p., (d) a canyon 3¾ miles from the mouth of the river with a 42 ft. head in a distance of 5,300, giving 23,000 h.p. and (e) a site at Granite Bridge 6 miles below Nelson, the power of which has not yet been estimated. None of the tributaries of this river have been investigated.

Pend d'Oreille River

This river only lies in British Columbia for 16¼ miles of its course during which space it has a fall of 423 feet. The discharge is anywhere from 10,000 to 13,000 second-feet. Three places are particularly suited for the development of power (a) at the junction of the Salmon and Pend d'Oreille 48,000 h.p. under a 74 ft. head, (b) at 15 miles, 30,000 h.p. under 47 ft. head and (c) at 9 miles, 29,500 h.p. under 44 ft. head. The tributaries of this river are unimportant for water development purposes.

Elk River

The report also deals with an investigation of the Elk River canyon from a power standpoint. The Elk rises in the Rocky Mountains and after a 110 mile course joins the Kootenay River. In about 4,000 ft. there is a fall of 174.75 ft. and it is calculated that the power possibilities at low water is 13,500 h.p. This could be augmented by storage to double the amount. It is stated that the works at the power house, without distributing systems could be installed for $25 per h.p.

Temperature Effect on Insulations

The effect of temperature on insulating materials is always of supreme importance to the designing engineer, and in this connection a recent paper by Steinmetz & Lamme on "Effects of Temperature on Insulations," reproduced in the March 15th issue of the Electrical News, introducing a number of interesting recommendations, has aroused considerable interest. A treatise has also just appeared on the subject of alternating current machinery by Barr & Archibald who publish some original results on the effect of temperature on the dielectric strength of a varied number of insulating materials. In this connection the authors say:

It is well known that when most insulating materials are subjected to prolonged heating at high temperatures their dielectric and mechanical strength is permanently weakened. With a view to determining the temperature limits consistent with the safe working of electrical machinery, a number of investigations were made regarding the effect of heat on the electrical and mechanical properties of such insulating materials as are usually employed in electrical machinery, more especially in the construction of low-voltage armatures and transformers. A number of specimens of various insulating materials were for a period of nine months kept in electrically heated ovens maintained at the temperatures 75 deg., and 100 deg., and 125 deg. C. respectively. The alternating pressure required to rupture these specimens was determined both in the case of the specimens heated to the different temperatures, and also in the case of a similar specimen which was not heated at all. As the results of the investigations form an important contribution to the literature on this subject, the results of some of the tests are reproduced in the accompanying table. The disruptive tests were carried out whenever possible on specimens which were placed between circular electrodes 5 square centimetres area, the upper one being loaded with a total pressure of 2 kilogrammes. In the case of tapes, etc., two rods 6.3 millimetres diameter were used with hemispherical ends, the pressure being 25 grammes. The voltage supply gave a sinusoidal e.m.f. of 50 periods.

The results of these tests show that most insulating materials improve when heated up to 75 deg. C., do not seriously deteriorate by further heating to 100 deg. C.—in some cases they actually improve—but show a rapid deterioration on heating to 125 deg. C. The initial improvement in dielectric strength is, of course, due to the expulsion of the enclosed moisture. The tests also showed that prolonged the mechanical properties of press-spahn and oiled fabrics. At 100 deg. C. these materials showed signs of deterioration after a few months and perished on further heating. At 125 deg. C. most of the specimens were much discoloured and deteriorated after a comparatively short time, the only material remaining in a fair condition at the end of nine months being micanite; but even this had suffered to some extent, due to the charring of the shellac adhesive used.

Material.	Thickness in Millimetres.	Temperature in Degrees C.	Average Disruptive Voltage.	Volts per Millimetre.
Press-spahn . . .	0.25	Normal	2843	11,400
		75	2640	10,560
		100	2778	11,100
		125	2888	11,550
Press-spahn . . .	0.6	Normal	5497	9,100
		75	5403	9,000
		100	5289	8,800
		125	5348	8,900
Press-spahn varnished	0.35	Normal	7696	22,000
		75	6243	17,800
		100	6787	19,400
		125	7600	21,700
Manilla paper . .	0.30	Normal	1847	6,150
		75	1712	5,700
		100	1800	6,000
		125	1613	5,370
Manilla paper varnished	0.355	Normal	3270	9,200
		75	4800	13,500
		100	5043	14,200
		125	8058	22,700
Mica linen . . .	0.23	Normal	2826	12,300
		75	3383	14,700
		100	3618	15,700
		125	3288	14,300
Mica paper . . .	0.125	Normal	2403	19,300
		75	2875	23,000
		100	3500	28,000
		125	2840	22,700
Oiled linen . . .	0.20	Normal	5750	28,750
		75	5826	29,100
		100	6623	33,100
		125	5124	25,600
Varnished canvas . .	0.40	Normal	7025	17,500
		75	5833	14,660
		100	3014	7,550
		125	1598	4,000
Dynamo tape . .	0.18	Normal	...	...
		75	760	4,220
		100	709	3,940
		125	896	5,000
Superfine dynamo tape .	0.11	Normal	485	440
		75	493	4,480
		100	487	4,400
		125	Perished	...

The efficiency of the transformer is 90 per cent. or more; of the steam locomotive 20 per cent. or less. To which class do **you** belong? Are you returning your employer in useful work 90 per cent. of what he pays you—or only 20 per cent? Think it over.

Get the Consumer Interested

Mr. R. B. C. Hammond, superintendent of light and power for the city of Vernon, B.C., has hit upon a useful method of drawing the attention of electric users to the various kinds of household equipment which may be had now-a-days at small cost. A sheet has been prepared showing the consumption of various household electrical appliances, the period through which they are likely to be required each time they are used, and the cost of that period. These are sent out with the bills every month and are said to be greatly appreciated by all the customers. A power rate of five cents per kilowatt hour is allowed the users of household equipments when a separate circuit and meter is installed. The list as sent out, with the information attached, is as follows:

Article	Average Watt Hour Consumption	Period of Operation Minutes	Cost during that Period Cents
Chafing dish	400	20	¾
Pint milk warmer	250	6	⅛
Quart food heater	500	6	¼
Coffee percolator	300	20	½
Stove, 6 inches	500	15	⅝
Stove, 8 inches	800	15	1
Broiler, 9 x 12 inches	1200	15	1½
Curling iron heater	60	15	3/40
Iron, 3 pounds	250	30	⅝
Iron, 6 pounds	500	30	1¼
Frying pan (7 in. diam.)	500	30	1¼
Waffle iron	500	12	½
Tea kettle	300	20	½
Glue pot, 1 quart	300	20	½
Soldering iron, 2 lbs.	200	30	½
Doctor's sterilizer	1000	30	2½
Bathroom radiator	1000	30	2½
Heating pad	50	60	¼

Splendid C. G. E. Report

The annual report of the Canadian General Electric Company for the year ending December 31, 1912, shows profits, before providing for depreciation and interest on borrowed capital, of $2,011,719. Interest and depreciation charges amount to $615,236, leaving a net profit for the year of $1,396,483. Dividends on preferred and common stock amount to $689,871, leaving a net surplus for the year of $706,611. $700,000 was added to reserve account which now stands at $2,369,531. This amount, added to the balance at credit of profit and loss account of $682,391, brings the total surplus to $3,051,922. The capital liabilities of the company are $2,000,000 of preferred and $8,000,000 of common stock, with mortgage obligations and bonds of subsidiary companies amounting to $905,567.

The officers of the company are now as follows: W. R. Brock, hon. president and chairman of the Board; Frederick Nicholls, president and general manager; W. D. Matthews & Hon. J. K. Kerr, K.C., vice-presidents; Sir Mortimer Clark, Hon. Geo. A. Cox, A. E. Dyment, Sir Rodolphe Forget, H. S. Holt, Hon. Robt. Jaffray, Sir Wm. Mackenzie, Jas. Ross, F. G. Osler; J. J. Ashworth is secretary and assistant general manager.

An Automatic Sewage Pump

In the town of Medicine Hat there is an interesting automatic sewage pumping outfit. During the flood periods the natural flow of sewage cannot force itself into the Saskatchewan. To overcome this the city has installed a duplicate plant consisting of a centrifugal pump of the Northey type, direct connected to a C.G.E. 15 h.p. motor through a flexible belt laced coupling. The motors are controlled by C.G.E. automatic compensators which in turn are controlled by a single pole switch and float ball.

When the plant is put in operation, the sewer discharge to the river is shut off, and settlement takes place in a well in which is immersed the suction pipes of the pumps. The discharge pipe from the pumps joins on to the main sewer discharge outside the pump house and runs out 900 ft. to the centre of the river. The units are guaranteed to pump 500 gals. each per minute, against 24 ft. head of water, plus friction losses.

The main feature of the outfit is that it starts and stops automatically as predetermined levels, and only requires to be looked at once a day, to fill up oil cups for the guide bearings on the 22 ft. vertical shaft. The weight of the pump impeller and shafting is taken by the main thrust ball bearing in the sub-base of the motor. As the motor rotor is also hanging from a ball bearing, it will be seen that little power is required to run the unit without load. These units were supplied and installed by the Canada Foundry Company's Calgary Office.

Petty Dishonesty

A case of more than ordinary interest to electrical companies came up in the Ottawa police court on March 19th, when the Ottawa Electric Company charged Jacob Bercovitch, a second-hand storekeeper, with fraudulently converting to his own use a number of electric lamps, the property of the company. Bercovitch buys the light for his store on the commercial or flate rate basis, under which system the company does not supply free lamps. His house, however, is supplied through a meter, on domestic rates, for which lamps are supplied free of charge. The allegation made against Bercovitch was that he applied for a number of lamps at the company's offices, saying they were for his house, but instead of using them there he used them in his store. For some time the company had been suspicious about this practice being followed so the lamps were marked when given out to customers who used the two systems.

The magistrate, before whom the case was tried maintained that the case was one for the civil courts. Mr. A. W. Greene, counsel for the company stated in court that through such corrupt practices the company loses about $10,000 yearly. Further prosecutions are to follow and a direct charge of theft is to be laid as the company is determined to stop this system of petty dishonesty.

Wireless Extensions

Mr. J. H. Lauer, the manager of the Marconi Wireless Telegraph Company of Canada, in an interview stated that three Marconi stations communicating between Lake Superior and Lake Huron were built last year, and the new station at Sarnia now under construction, will be in commission at the opening of navigation. This will give a direct through communication from Port Arthur, at the head of Lake Superior, down to Sarnia, at the foot of Lake Huron. It was also the intention of the government to proceed with the construction of a station at Port Stanley, on Lake Erie, and Toronto and Kingston, on Lake Ontario. This would make complete the entire chain of stations from the head of navigation on the Great Lakes to Cape Race, the extreme eastern limit of Newfoundland.

At the present time there is through communication between Montreal and Cape Race. The apparatus at the latter point has now a steady radius of between four and five hundred miles, and can reach ships from 1,200 to 1,500 miles east of New York. The average range for the standard set for small ships has a radius of 200 miles, but the large liners carry a much more powerful apparatus.

During the past summer wireless engineers explored the great rugged strip of the Labrador coast and the immense wilds lying around Hudson Bay, with a view to linking them with the rest of the world by the Marconi system. Further expeditions will continue this work as soon as spring opens up.

Equipment for Calgary

The city of Calgary is now installing a 1,000 kw. d.c. auto-synchronous motor-generator, supplied by Messrs. Kilmer, Pullan & Burnham and manufactured by the Swedish General Electric Company. They are also now arranging to install a 1,000 kw. d.c. Dick-Kerr synchronous motor-generator. Both of these motors will be used for supplying power to the municipal street railway system. It is further expected that in the course of the next thirty days a 2,500 kw. turbo-generator, Belliss & Morcom type, and supplied by Messrs. Laurie & Lamb, will be installed in the main power station.

The city has sent a repeat order for a 500 kv.a. oil-insulated single-phase 12000/2400 volt transformer to the Packard Electric Company, which transformer will be installed in the Ogden substation, and will complete two banks of three transformers of the same size. This substation is used for supplying power to the C. P. R. shops, also for the operation of a motor generator for street railway purposes. They have also repeated an order to the Canadian Westinghouse Company for one 3,000 kw., three-phase 12,000/2400 volt transformer—a duplicate of two now in operation in the city.

A by-law was voted on, March 5th, authorizing the sum of $400,000 for the erection of additional sub-stations and equipment, also for underground cable and light and power extensions in the various parts of the city. Estimates for street lighting have been prepared which show that $105,000 will be required for 1913, as compared with $59,000 for the year 1912.

Westminster Power Company

Plans are now under way for the establishment of an extensive hydro-electric power plant by the promoters of the Westminster Power Company, Limited, a concern which came into prominence recently through its applications for extensive water rights in the vicinity of Vancouver, with a view to generating electric power for transmission to all parts of the New Westminster and Vancouver water districts. The application in the B. C. Gazette for approval of the undertaking, is signed by Messrs. G. E. Corbould, president, and J. R. Grant, secretary, members of the firm of Corbould, Grant & McColl, solicitors, New Westminster, but the names of those promoting the scheme have not yet been disclosed. The plans of the company, which have been filed at the provincial government offices in New Westminster, show the hydro-electric development to be located in section 33, on the Indian River, close to the upper end of the North Arm of Burrard Inlet, and only a few miles distant from the main generating station of the Vancouver Power Company—a subsidiary concern of the B. C. Electric Railway Company.

The plan is a most comprehensive one, involving the harnessing of numerous small streams at a high elevation above the power house, and piping the water down to the plant where great volume and force are obtained. One of these sources of power is designated as Lake No. 2, located at an elevation of 1,926 feet above the power plant, and about 3½ miles distant. Lake No. 1 is 2,114 feet above the power house, and about an equal distance away in a more northerly direction. Dams across the ends of both lakes are shown, these serving the purpose of raising the lake level and increasing the amount of the storage water.

The streams from which the water supply will be captured are: Hixon Creek, a creek flowing into the Mesliloet (Indian) River from the east through township 6; Brandt Creek, a creek flowing into the Mesliloet River from the east through township 7; Young Creek, flowing southerly into Brandt Creek, and Norton Creek, flowing westerly into Brandt Creek. All of this water is led to the forebay, whence it is piped to the power house. The plans state that the effective head of water will be about 1,800 feet. The plans have been filed in the government offices pursuant to the requirements of the Water Act.

Social and Luncheon Club

The social club connected with the office organization of the British Columbia Electric Railway Company at Vancouver, B.C., has recently entered upon a new field of activity by the organization of a Luncheon Club. This auxiliary organization has as its aim the furnishing of a daily luncheon at moderate cost to its members. The plan has now been in actual operation for several weeks and the results seem to indicate that it will be successful. The management of the B. C. Electric loaned to the club the entire initial outfit, including the full equipment for a gas kitchen, china, cooking utensils, furniture, etc., as well as providing the cost of alterations incident to the arrangement for a kitchen and dining room, the outlay being about $1,500. The Social Club gave part of its games room for use as a kitchen and the balance of this room is used during the lunch hour for dining quarters, the room being changed again for the purpose of games at night.

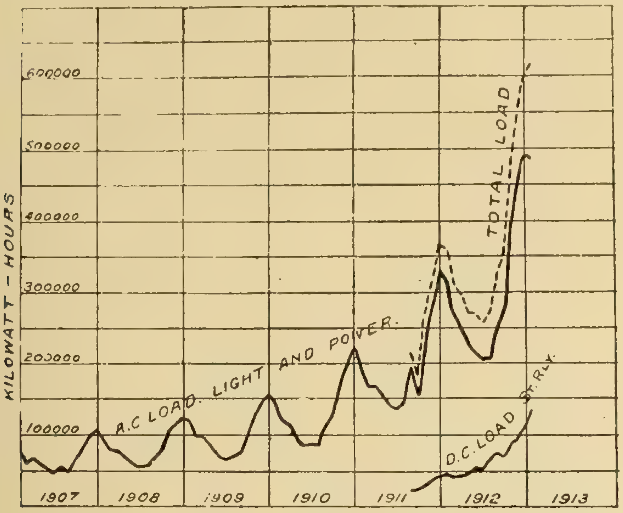
The price charged for meals is $1 for the five days of the week, no meals being served for less than one week. From 100 to 125 persons have taken advantage of the offer during the first two weeks of the Club's operations, and it is probable that the membership will grow now that the organization has been successfully launched. The government of the club is vested in a committee of five, selected by the members, a representative of the company management and a representative of the Social Club. The only help employed by the Club are a chef and his helper, the luncheon being arranged on the cafeteria plan, each member waiting upon himself. The result of the first week's operation of the Club was a deficit of $12, but on the second week this deficit was turned into a balance of $6, this showing demonstrating that it is possible to work out the objects for which the club was organized. The members of the staff generally agree that the project is a good one as the Luncheon Club affords the members an opportunity of securing a substantial mid-day meal at a moderate price, the food and service provided being far better for the money than it is possible to obtain at the public dining places in the city.

One of the best results of the Luncheon Club has been that it brings the men who usually meet each other only hurriedly and in a business way, to the club quarters where they meet round the dining table in social intercourse, and thus become better acquainted with each other. The provision made by the Social Club of reading room, billiard room, social hall, etc., adjoining the dining room makes the after dinner gatherings to the various quarters a real pleasure for the employees of the company.

Regina Doubling Each Year

As illustrated in the accompanying curves, the output of the Regina electric light plant is practically doubling each year. This curve shows the monthly output for a number of years past. Under these conditions it is interesting to note the rates charged for light and power in Regina. These are given below and it will be noticed that this is one of the few Canadian points where two-rate meters are being used.

For light used in one installation and registered in one month on one meter:—First 300 kw. hours at 7c; all used in excess of 300 kw. hours, 6c per kw. hour. Light used in the day time (off peak hours) on two-rate meter in installations of over 5 kw. of maximum demand, 5c per kw.h.



Curve showing monthly output of Regina electric plant

For power used in one installation and registered in one month on one meter:—First 300 kw. hours at 5c per kw.h; 300 kw.h. to 600 kw.h. 4c; all in excess of 600 kw.h. 3½c. For power used in day time on two-rate meters in installations over 5 kilowatts of maximum demand, 3c per kw.h.

Energy for heating and cooking is supplied at power rates. A discount of 10 per cent. is allowed for payment within ten days. A minimum rate of $1 per month is charged on all light services and $1 per month per connection on power services, or kw. of demand for heating services.

Special rates are arranged on large power services according to the condition of service. Meter rental for light is 25c per month, for power 50c per month and for two-rate meter 50c per month.

Lethbridge Annual Report

The following figures, from the annual report of Mr. Arthur Reid, General Superintendent of Light, Power and Street Railways for the city of Lethbridge, Alta., are indicative of what capable management coupled with western activity can produce.

The Electric Department granted 495 permits for wiring both motors and lights, made 386 new connections and read an average of 1,451 meters every month. Inspection fees collected amounted to $327.00. Our line construction was as follows:—New pole line, 3.7 miles; new wires strung on existing poles, 5 miles; street lighting wires on wooden poles, 3.6 miles; street lighting wires on iron poles, 7,000 feet; fire alarm wires, 2 miles; police telephones, 4.7 miles; there was also placed in service 86 cluster posts, 4 lights each; 2 electric signs on the 9th street bridge and four 5-light standards in the Galt Gardens.

The distribution system at the present time is made up of the following:—

	kw.
Total number of transformers	251
Total capacity of transformers	1,522
Capacity of lighting transformers	948.8
Capacity of power transformers	573.2
Lighting, connected load	1,254.5
Power, connected load	584
Total, connected load	1,838.5
Number of light and power consumers	1,627

The 1912 financial statement is as follows:—

Revenue	$120,364.26
Expenditures	96,952.25
Profits	$ 23,412.01

The 1912 expenditures were distributed as follows:—

Salaries	$ 3,527.00
Power house wages	11,554.19
Fuel, water and electricity	17,852.24
Water	720.00
Oil and waste	979.99
Plant repairs	3,731.28
Poles, wires and meter repairs	4,289.83
Street lighting maintenance	3,771.69
Interest and sinking fund	35,735.57
Meterman's wages	1,080.00
Power house expense	688.33
Sundries	2,549.22
Rebates on guarantee deposits	2,489.00
Wiring inspections	871.43
Discounts	7,112.48
Total	$96,952.25

In the power house a large amount of construction work has been done consisting of the addition of a 1500 kw. turbo-generator; four boilers totalling 1,140 h.p.; one 320 tube economizer; one 50 kw. exciter engine and generator; draft apparatus; addition to boiler room and switchroom and one new feed pump. This brings the total capacity of the power house up to 2,440 kw. The electric output was 2,250,300 kw.h. Total water pumped was 417,317,000 Imperial gallons; maximum quantity pumped per month 43,062,000 gallons in June; minimum quantity 26,713,000 gallons in February; maximum daily consumption 2,023,000 gallons on June 26th. Coal consumed for electricity 8,091 tons. Coal consumed for water pumping 1,814 tons. Total coal consumed 9,905 tons.

Cost is 1.2c. per kw.h.

The cost of production of energy per kw.h. during the last two years is as follows:—

	1912 c. per kw.h.	1911 c. per kw.h.
Coal cost	.647	.604
Labor cost	.513	.67
Plant repairs	.016	.208
Oil and waste	.043	.057
Water	.031	.043
Sundries	.030	.023
Total	1.280c.	1.605c.

This shows a slightly lower operating cost per unit in the power plant during 1912, which is largely due to the increased load and better operating conditions. These costs are figured on a basis of 8,760 hours which was the total number of hours the plant was in operation during the year.

"Facts and Factors" of Lethbridge Municipal Plant

Population	12,000
Consumers per 100 of population	13.56
Station rating, kw.*	2440
Station rating per employee, kw.†	78.7
Station rating per capita, watts	203.3
Ratio of station rating to connected load, per cent.	75.
Average load during operation, kw.	305.

Ratio average load to station rating, per cent.	12.5
Annual load factor, per cent.	32.
Investment per kw. of rating	$210.00
Investment per capita	42.66
Gross income per kw. of rating	49.32
Gross income per consumer	73.97
Gross income per capita	10.03
Gross income per $100 invested	0.0534
Gross income per kw.h. generated	0.0534
Ratio of expense‡ to gross income, per cent.	85.
Net earnings per $100 invested	$4.57
Total hours operations for the year	8,760
Connected load	kw.
Incandescent lamps	1254.5
Motors	584.
Total load	1838.5
Metered services	1,627
Full-load rating of plant, kw.	2,440
Maximum load, kw.	800
Transformers	kw.
Light	948.8
Motors	573.2
Total transformers rating	1522.

*Full load capacity of plant.

†Entire force, station, distribution, clerical and general.

‡Includes interest and taxes but not depreciation.

Electric Machinery Design

At a meeting of the Montreal Electrical Society Prof. Alex. M. Gray, B.Sc., assistant professor of electrical engineering, McGill University, lectured on the "Construction of Electrical Machinery." The lecturer stated that the purpose of the address was to give in a simple manner an explanation of the fundamental principles on which the operation of electrical machinery depends and to point out the recent developments in the subject and particularly the limitations which are met. The fundamental principles of the electro-magnet, the generation of electromotive force, and of commutation were taken up, and the application of these principles in actual machines was pointed out and illustrated with lantern slides. The following points of interest were brought out.

Every electrical machine, as for example, an alternator, consists of a magnetic circuit of iron, an electric circuit of copper, and a separating medium of insulating material to prevent the copper, which is at a high potential, from coming in contact with the iron, which is connected to the ground. This insulation is the weak point about such machinery because it consists principally of paper, cotton and mica, none of which are very strong mechanically, and the two former become very brittle when subject to a temperature greater than 90 deg. cent. and then pulverize due to vibration. Overloading a machine increases its temperature rise and increases the chance of damage to the insulating material.

Forced Ventilation

Some pictures of turbo-alternators were shown and it was pointed out that in order that the machine be quiet in operation at the high speeds, and also that they may be effectively cooled, it is necessary that they be totally enclosed and cooled by forced ventilation. A 6000 kilowatt ampere machine requires 25,000 cubic feet of air per minute for effective cooling, and if even a small amount of dust be in the air it will soon clog up the air passages and then the machine will overheat; the air for such machines should therefore be filtered through cheese cloth or be passed through a spray of water before it enters the machine. The water vapour carried into the machine in the latter case has not been found to condense on or to damage the insulation.

Due to the enclosed construction and to the depth of iron surrounding the rotating part of a turbo-alternator it has sometimes been stated that even should such a machine run away and the rotor burst no damage to external objects would be done because the flying parts of the rotor could not get out. This has not been found to be the case; when one of these machines did burst on an overspeed run some parts of it could not be found, some were found half a mile away, and there was a large hole found in the roof of the building. The surface speed of a turbo rotor is about 4.5 miles per min. at normal speed and they are all tested at 25 per cent. overspeed, the turbine itself is supplied with an overspeed device which cuts off the steam supply when the machine runs to 20 per cent. above normal speed.

Water wheel generators have to be built so that they can run safely up to about twice normal speed. The blades of a water turbine run at about half the speed of the water flowing. If then the load on the alternator is suddenly released, due for example, to the opening of a circuit breaker, the turbine will speed up till the blades are running at about the same speed as the water or at about twice normal speed. It is not possible to throttle a large volume of water in the short time that it takes the machine to speed up, so that all specifications for alternators to be connected to water turbines should call for a test to be made on the machine at twice normal speed to ensure that it is mechanically strong enough.

In introducing the subject of high voltage transformers it was pointed out that a few years ago the limit of voltage of a long distance transmission line was 66,000 volts, because the insulators for such voltage had to be long and, if of the pin type then in use, were not mechanically strong because they were subject to bending. With the introduction of the suspension insulator the line insulation problem was solved and the voltages were increased to 110,000, at which point it was found that the transformers were beginning to give trouble. Much experimental work on high voltage transformers has been done by the different manufacturing companies and many of the insulation problems solved, so that now there are in operation transmission lines of 150,000 volts with transformers operating at that voltage in the open air, and no one would say that the limit of voltage had been reached at that point.

D.C. Transmission

In competition with the high voltage alternating current system the Thury direct current system has made some progress and, under special circumstances, is the only thing that can be used. With this system, at present, voltages as high as 90,000 are used, but such voltages have to be generated in revolving machinery with commutators, because in the d.c. system there is no piece of apparatus to take the place of the transformer. So far it has not been found possible to build commutators commercially for more than 4,500 volts, so that for a 90,000 volt station twenty commutators connected in series are required and this does not appeal to Canadian engineers as being the acme of safety, especially as each of the generators have to be insulated from the ground and have also to be insulated from the turbine driving them by insulated couplings. Still further, the receiving station requires the same number of machines which must again be connected to alternators because the distribution of power is carried out by alternating current. It is evident then that such a system is complicated so far as the power station and the sub-station are concerned, when the power is delivered in bulk, and that only a great saving in the line would compensate for all the other complications. It is in the line that the Thury system is simple. It is possible to build cables for 90,000 volts d.c. and the power can be transmitted through a single cable and the ground used as a return.

In densely populated countries, where the cost of a 200 mile right of way would be exorbitant, then the Thury system may be considered and the line laid as a single underground cable. In the proposed transmission from Trollhattan to Copenhagen, where there is 3.5 miles of water to cross, the Thury system has been recommended because a cable can be built for high voltage d.c. to be laid and operated under water, while an a.c. cable cannot be built and a transformer station would be necessary to reduce the voltage to 20,000 at which value power could be then transmitted across the water by a submarine cable.

The lecture closed with a discussion of transformer cooling, the several methods being shown by slides. For small sizes the transformers are placed in a tank which is filled with light oil; this oil circulates due to the heating of the transformer and carries the heat from the hot points to the tank from which it is dissipated to the air. For larger sizes a plain tank has no longer sufficient surface and the tanks are corrugated or are even cooled by external pipes which are connected to the tank at the top and bottom and give a large increase of tank surface and a greater cooling effect for a given floor space. Then finally the water cooled transformer was shown which is cooled by circulating water through water pipes in the top of the tank to which coils the heat is carried by the oil; it is important that the water used for such cooling does not contain sediment because this will clog up the pipes and spoil the cooling effect.

The lecture was followed by considerable discussion on the part of the members of the society, such questions as corona formation, wireless transmission of power, strains on the end turns of transformers and sub-synchronous speeds in induction motors being taken up. During the course of the talk, Mr. Gray referred at some length to his article on "Homopolar Induction Machines," which appeared in the March issue of the Electrical News.

Western Canada Power Company

Much interest was aroused at the coast recently by the announcement of Mr. Wm. McNeil, general superintendent of the Western Canada Power Company, to the effect that the company is contemplating the construction of a power line across Burnaby Municipality to the North Arm of the Fraser River. This line would supply power to a large portion of Burnaby, the manufacturing sites along the North Arm of the Fraser, and on Lulu Island.

While it is understood that a definite route has not yet been decided on, it is thought probable that the line will commence at the Ardley sub-station of the company, and extend along the Royal Oak road to the northern shore of the North Arm of the Fraser. In order to cross the river, the company is considering the advantages of a submerged cable which would carry the power to Lulu Island at minimum expenditure without interference with the shipping. The construction of this line will be of great benefit to the entire Burnaby district, and will stimulate industrial progress in a section of the municipality which has hitherto enjoyed but few advantages in electrical power development.

Twenty Miles During 1913

The result of a recent conference held between Hon. Thos. Taylor, Provincial Minister of Public Works and Mr. Wm. McNeil, assistant general manager of the Western Canada Power Company, and chairman of the Burrard, Westminster, Boundary Railway & Navigation Company, is contained in the announcement that the Government of British Columbia will this year expend $200,000 on the construction of the combined railway and traffic bridge across the Pitt River, to be used by the railway company. It is estimated by the government authorities that this bridge, which will be completed in 1915, will cost upwards of $700,000.

The Western Canada Power Company on its part undertakes to commence the construction of some twenty miles of railway this spring between Stave River and Pitt River, and to complete the work by the end of the present year. This is a section of the electric road to be ultimately constructed by the company along the north bank of the Fraser River between Mission City and Vancouver.

Certain amendments to the railway company's charter are being applied for during the present session of the Federal Parliament, also an extension of time for the completion of the railway. As soon as these have been granted the work of construction between Stave River and the Pitt will be commenced.

Light and Power in Fraser Valley

By the terms of a recent agreement with the municipality of Matsqui, Fraser Valley, B.C., the Western Canada Power Company, Vancouver, commenced the erection of pole lines early in March to supply current for light and power purposes at all points throughout the district. Under its contract, the company is to complete about ten miles of this line within ninety days, from the date of starting work. In addition to the construction of many miles of line for local distribution, an agreement has been reached with the council by which the company is authorized to build and maintain the big transmission line from its main generating station at Stave Lake through Matsqui to Sumas. Four miles of the latter line will run through Sumas municipality, and for the use of the highway, the company will pay an annual rental of $400.

Lines will also be erected by the company at an early date to supply power to the pumping stations at the government dyking project in this district. Here by the use of electricity the cost of operating has been considerably reduced. A number of other larger users of power will profit materially by the introduction of cheap electric power in the district.

Fraser Bridge Illumination

The provincial government is seeking an arrangement with the Western Canada Power Company whereby the company will agree to install the lamps and furnish the light across the southern half of the Fraser River bridge at New Westminster, thus completing the lighting equipment of the structure. The proposal to employ city lighting was abandoned owing to the refusal of the New Westminster city council to supply light for less than 5 cents per kilowatt hour, a rate which the government authorities considered exhorbitant.

Important Coast Developments

Extensive as has been the hydro-electric development of the lower mainland of British Columbia, the future of the whole of the Fraser River region in the production of electric energy by the utilization of the water powers tributary to this great river, is such as to arouse the liveliest imagination. The latest proposition to harness some of the mountain streams which is attributed to the Mackenzie & Mann interests, calls attention again to the vast resources of the province in this respect.

Not only throughout the lower mainland, but right up the valley of the North Thompson to the Yellowhead Pass, the development of power will, in time, be a feature of the economic progress of these regions. It means intensive settlement, a greater volume of agriculture and manufacturing, and an increasing and prosperous trade for all sections and especially the coast cities of the province.

For some time past the Mackenzie & Mann interests have been active in securing water rights at various points on the line of the Canadian Northern Pacific Railway in British Columbia, and recently the authoritative announcement was made that the company intend to supply light and power to Port Mann and other points on the line, as well as to electrify the entire stretch of road from Yellowhead Pass to Port Mann, and ultimately between Port Mann and Vancouver. One of the biggest projects of the railway builders is to erect two dams across the valley just east of Hope, where the Nicolum River empties into the Coquahalla, and erect a hydro-electric plant, at the confluence of the two streams, capable of developing some 30,000 horse-power under a head of 1,800 feet. In addition to the power from the Nicolum and Coquahalla it is also planned to drive a tunnel through the Divide to the Sumallow River level, and this stream will then be in part diverted from the Skagit to the Nicolum. The water will be held there in a huge storage reservoir with a capacity of 10,000 acre feet. From this storage reservoir to the generating plant, the water will be conveyed by penstock or tunnel. The company expects to divert 150 cubic feet of water through the tunnel to the Sumallow to add to the large volume of water carried by the Coquahalla and Nicolum rivers.

Generating Plant near Hope

The generating plant will be situated about four miles east of Hope Station on the Canadian North Pacific Railway. One of the dams will be ten miles from Hope and the other about 12 miles further eastward. The point of diversion of the Sumallow, which will form the second dam and storage reservoir, will be some twenty-one miles from Hope.

Mr. L. N. Jenssen, division engineer for the Canadian Northern Pacific, who has been engaged in surveying and staking the project, is now engaged in preparing plans and formulating the entire scheme. Application for the lease of the water rights in the Hope district has already been made to the water recorder at Ashcroft.

It is interesting to note in this connection, that the C. N. P. Railway has definitely decided to electrify the branch line from Kamloops to Vernon. Mr. R. A. Barton, who was the engineer in charge of the preliminary development of the Couteau Power Company, near Ducks, just north of Kamloops, stated recently in Victoria that the C. N. P. Railway has acquired the charter and interests of the Couteau Power Company, and it is believed the company will utilize the power plant to electrify the branch line into the Okanagan district. This power company had previously provided for the expenditure of $2,000,000 in development work, and it is understood this will be undertaken by the railway company. Should the work be carried out as planned the C. N. P. line in the Okanagan will be operated as an interurban line, thus effecting a considerable saving in its operation.

Rights at Other Points

The company holds water rights and licenses at other points in the interior of the province with the apparent intention of their use in electrical propulsion of trains across the continent. Under the Mackenzie & Mann charter in British Columbia, current may be sold at any point on its system, or any use may be made of it, so that within the next few years it is quite possible the company may prove an active competitor in the field of power supply in the lower mainland.

Should the C. N. P. Railway definitely decided to electrify its entire mountain division the company will be following the example of the Great Northern and Northern Pacific companies, which are also adopting that course.

It is now generally understood at the coast that the Canadian Pacific Railway intends to operate its trains through the projected tunnel at Glacier, B.C., by electricity, and that the generating plants to be erected by the company at Illecillewaet and on the Kicking Horse River, will be large enough to supply power for the whole of the Mountain division. It is believed that electricity will be used on the company's lines through the mountains as soon as the tunnel is completed.

An Electric Truck Campaign

A campaign has been inaugurated this spring in the coast cities of British Columbia for the introduction of electric vehicles. Over 5,000 autos are now in use in British Columbia, the great majority of which are used at points near the coast. Hitherto the gasoline car has been the prevailing type with a small scattering of electrics. The energetic campaign which is being inaugurated this spring, however, has resulted in bringing electric vehicles before the public until they now occupy a position which bids fair to make them a real competitor of the gasoline car for public favor.

The campaign is being carried on for the production of both pleasure vehicles and commercial cars. Nearly all the types of electric vehicles are represented on the coast by agencies which for some years past have been selling a small number of cars annually. The introduction of these cars with their advantages of cleanliness, silent running, ease of regulation and low cost of maintenance and operation has attracted attention to the type of vehicle and renders the advance campaign which is being carried on this spring much easier than it would otherwise have been. Accurate statistics as to the number of electric pleasure cars in service in Vancouver and Victoria are not available but reports from the agencies indicate that the total is now worthy of note and that it will probably be doubled before next season. One firm in Vancouver which operates a garage has made an attractive offer in connection with the sale of electrics. This concern provides for the garaging of the electric, charging of battery, delivering and collecting vehicle daily for $30 per month, thus placing at a cost of $1 per day an electric pleasure vehicle at the service of the owner.

B. C. E. R. Co's. Electric Trucks

In the field of electric trucks, the B.C. Electric Railway Company this year took out an agency for the General Vehicle Company and have been pushing the claims of electric trucks vigorously in Vancouver. This concern is now operating a fleet of 5 electric trucks in connection with its Vancouver light and power service and it is probable that this number will be increased shortly. The firm reports that there is now in Vancouver a 3-ton electric truck which has been in constant service for the last seven years and is today still giving perfect satisfaction although constantly on the road. In Victoria a number of electric trucks are in service and the list will be increased this season through repeat orders by satisfied users of the equipment and new firms which have been won over by the records shown by the vehicles in actual operation.

To satisfy the demand for current for electric trucks, public charging stations are maintained by the B.C. Electric as well as a large number of private firms operating garages. There are at least nine public stations in Vancouver in addition to the eight charging stations maintained by the B.C. Electric at its various sub-stations. On Vancouver Island there are eight public charging stations operated in connection with garages. In addition to these public stations there are a large number of charging equipments installed in private garages. The B.C. Electric make a maximum charge of 5 cents per kw. hour for current for electric vehicles, this amount being reduced as the consumption increases.

Viewing the field as a whole it is stated that the outlook for electric vehicles on the Pacific coast is excellent. At the present time both on Vancouver Island and the British Columbia mainland public authorities are taking an active interest in the subject of good roads.

B. C. E. R. Sub-station Changes

Operations have been started by the British Columbia Electric Railway Company on the construction of a large receiving station which will regulate the distribution of current to the company's territory on the southern mainland of British Columbia. The site for the building is in D. L. 118 Burnaby, just on the boundary line of the city of Vancouver where the company has a large tract of land. The total expenditure to be made on the property is estimated at $250,000. The buildings to be erected on the site are two in number, a main receiving station and a small sub-station. Both will be of steel frame and reinforced concrete type of construction and fireproof throughout. They will be one storey in height with an additional storey for the transformer galleries.

In the receiving station there will be four incoming lines delivering the current at 60,000 volts. The electrical equipment will consist of four banks of three transformers, each with a total capacity of 36,000 kw., by which the current will be stepped down from 60,000 volts to 11,000 volts for distribution to the sub-stations.

The sub-station, which will be erected in connection with the receiving station, will be equipped with two motor generator sets and a bank of 11,000/2,200 volt transformers. From this station will be regulated the supply of current for railway purposes and for public and private lighting in the vicinity of the station.

Only One High Pressure Station

The electrical equipment of both stations includes the usual installation of a full equipment of lightning arresters, switching apparatus, etc., the company's electrical engineers having designed the stations in accordance with the latest methods followed by central station and electric railway companies. At the present time the current from the company's generating station is sent to the Vancouver sub-station and other sub-stations at high voltage. When the new sub-station is completed, the Vancouver station and other stations now connected with the transmission lines will be used as sub-stations, receiving their current at 11,000 volts from the Burnaby station. In connection with the new arrangement the B. C. Electric will reconstruct its transmission system from the power house on the North Arm of Burrard Inlet to Burnaby, in order to enable the current to be carried at 60,000 volts.

As soon as the Burnaby receiving station is completed the company is planning the erection of a similar station near Sapperton, just on the outskirts of New Westminster. The equipment of this plant will be almost identical with the Burnaby station and the plans call for an expenditure of about $200,000. From the Sapperton station, power will be sent to the company's sub-stations in the South Fraser Valley, which cover the supply of the Fraser Valley interurban line and the demands of private parties for light and power in the district at 34,000 volts. From this point will also be distributed the current for the various sub-stations lying to the east of Sapperton. In the plans, arrangement has been made whereby in case of accident to the transmission line, current from either the Burnaby or Hastings station may be supplied to any point in the company's territory.

Another Vancouver Station

In Vancouver the B. C. Electric is now erecting a substation covering the west end of the city, the residential and apartment house centre. This building will be 60 by 68 feet in size, one storey in height with an additional storey for the transmission gallery, and fireproof throughout. Structural steel with brick curtain walls and a concrete roof are being planned. The estimated expenditure on the station will be in the neighborhood of $100,000. Current will be fed to the building at 11,000 volts, transmission lines being arranged from the Vancouver sub-station as well as the Burnaby receiving station, thus affording an alternate base of supply in case of accident to either lines. The electrical equipment of the building will consist of two 1,000 kw. d.c. motor generator sets, consisting of 11,000 volt motors and 600 volt generators, this equipment regulating the current for the tram lines in the section and the d.c. current used by elevators in apartment houses. The station will also be equipped with one bank of three transformers of 7,500 kw. capacity for regulating the private and street lighting of the district.

Personals

Mr. E. S. Jefferies is electrical engineer of the Steel Company of Canada, Limited, Hamilton, Ont.

Mr. Alexander Shaw has been appointed chief claims agent and assistant secretary-treasurer of the Montreal Tramways Company.

Mr. George W. Thompson, superintendent of the light and power department of the City of Westmount, P.Q., has been appointed acting controller of the city.

Mr. Thomas Ahearn, president of the Ottawa Electric Railway Company, and Mr. James D. Fraser, secretary-treasurer, left on March 27th for a two weeks trip to Cuba, Jamaica and Panama.

Mr. F. D. Burpee, Superintendent the Ottawa Electric Railway Company, was married in Oswego, N.Y., on Easter Monday. The employees of the company presented Mr. Burpee with a comfortable and handsome arm chair as a wedding gift.

Mr. A. G. Sangster, formerly electrical superintendent of Saskatoon, will open an office in that city as consulting engineer on electrical and hydraulic work. Mr. Sangster has recently been retained by the town of Rosthern in connection with work there.

Mr. A. Kastella, chief engineer of the Grand Trunk power plant at Stratford, has been appointed chief engineer of the Grand Trunk Central station and Chateau Laurier at Ottawa. Mr. Kastella will have charge of the lighting, heating and equipment of the terminal and hotel.

New Vernon Plant in Operation

First Diesel Oil Engine Plant in British Columbia— Another Unit will be purchased at once

On Monday, February 24th, before a large interested gathering, Mrs. J. T. Mutrie, wife of Mayor Mutrie, of Vernon, B. C., started up the new Diesel oil engine set. This unit has been locally named the "W. H. Smith, No. 1," in honor of Alderman Smith, chairman of the electric light department.

As this Diesel engine was the first of its kind to be installed in British Columbia the city council thought it only proper and right that its operation should be brought prominently before the citizens of Vernon and surrounding towns, and invitations were issued by the mayor and council to the members of the Board of Trade and ex-councillors of Vernon and to municipal officers of the neighboring municipalities, to attend the ceremony of christening and starting up the new engine at 4 p.m. Monday, February 24th. A general invitation was sent out to the Vernon citizens to inspect the unit at 8 p.m. the same evening.

Before the engine was started several prominent members of the city addressed the guests. It was pointed out that the load had increased by 50 per cent. during 1912 so that it would be necessary to prepare for a much larger load in the near future. The present capacity was stated to be 450 h.p. but there was a 600 h.p. load definitely in sight. Alderman Smith, chairman of the electric light department took occasion to speak on the new by-laws which were being placed before the people, asking for another Diesel unit of 500 h.p. capacity as well as extensive additions to the street lighting system. These by-laws have since been passed and call for the expenditure of $100,000 in the near future.

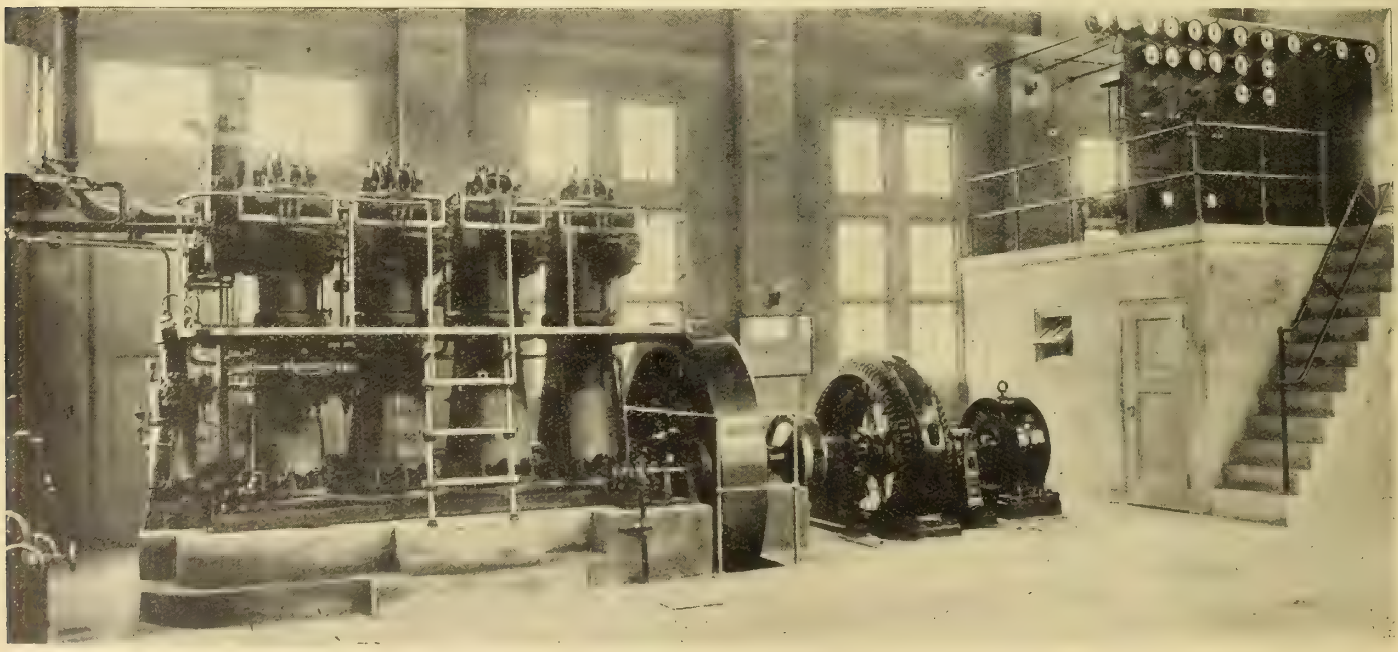
Up to the present the Vernon plant has consisted of a 14 in. x 36 in. Jenckes tandem compound condensing Corliss engine running at 92 r.p.m. belted to a 200 kw. Westinghouse type S, d.c. generator. Two Jenckes return tubular boilers of 105 h.p. each with Wainwright heater, supply the steam for this equipment. Comparative figures show that the fuel consumed during 1912, using cordwood at $6 a cord, cost $12,881, whereas if oil engines had been used it would only have cost $5,659. This saving of between $7,000 and $8,000 is a large item and when the second Diesel engine is installed (tenders are already called) it is proposed to let it take care of the interest and sinking fund of the money raised by debenture. As the money invested in this way will be revenue producing, it is calculated that the second unit will, practically, not cost the citizens one cent.

With the old steam plant however, although the cost was $6 per cord for wood, the rate charged was lower than in any other steam operated plant in the province. In spite of this the plant produced sufficient revenue to meet the operating expenses, the yearly contribution to the sinking fund, the interest on the investment, allow a liberal amount of depreciation on equipment and still leave a fair margin of profit.

Exterior power house, Vernon, B. C.

The new plant is a 200 h.p. Mirrlees, Bickerton & Day, 4 cycle, 4 cylinder, single acting Diesel engine operating at 252 r.p.m. This engine was installed by the Canadian Boving Company of Toronto under the supervision of Mr. T. Steele. The generator is a direct connected, 156 kv.a. Westinghouse, 3-phase, 60 cycle, 2200 volt unit with a 10 kw. exciter unit, 110 to 140 volts, on the end of the generator shaft. The old steam plant will in future, operate in parallel with the new generator.

The Vernon plant was constructed under the direction of



Interior Vernon municipal oil-electric plant—Switchboard and office to right.

Mather, Yuill & Company, consulting engineers of Vancouver. During the erection of the reinforced concrete power house building this firm's own cement expert was present and tested every layer of concrete with a concrete testing machine. The electrical work was installed under the personal supervision of Mr. C. Yuill. All the wiring is suspended on iron racks in cement trenches with lead encased high tension cable. From the switchboard power and light circuits run underground, with lead cable run in loricated conduit, to the centre of distribution terminating at both ends in high tension pot heads. From the centre of distribution, which is central, three and single-phase light and power circuits will be run so that the voltage will have a minimum drop and be normal throughout the city. On the different circuits supplying power outside the city limits, pole type automatic regulators will be used and when the new construction is completed the distribution system will be first-class overhead construction. All poles will be painted and stepped, not less than 10 in. diameter at the small end, and the butts will be treated with some reliable compound.

The new Diesel unit has now been in operation running continuously for a week and is giving every satisfaction. The engine can be started up from rest in 60 seconds and only one man is required to start and attend it during running. The photographs herewith show the exterior of the power house and also the arrangement of the equipment in the power house with the superintendent's office surmounted by the switchboard on the right hand side of the picture. We reproduce these photographs through the courtesy of the Vernon Photo Company. Mr. R. B. C. Hammond is the superintendent of light and power in the city of Vernon.

One hundred feet from the power house two 5,000 gallon oil tanks purchased from The Robert Hamilton Company of Vancouver are installed below the ground level, from which point by a systematic arrangement of piping, the oil can be controlled almost at will, reducing labor and measurements to a minimum.

Switchboard

The switchboard is mounted on a concrete and steel gallery above the rheostat room and superintendent's office. This switchboard is of 5 panels and is equipped with all the usual standard instruments, together with wattmeters, power factor meters, synchroscope, frequency indicator, etc. The voltage is controlled by a Tirrill regulator. By a system of auxiliary d.c. bus-bars the two exciter generator sets can be run in parallel, singly, or either one excite both alternators. All outgoing feeder circuits run from a feeder panel with overhead time limit automatic oil circuit breakers, with relays connected to the three legs of each circuit.

Power House

The power house building is of steel reinforced concrete construction 50 ft. x 38 ft. 33½ ft. high. Roof is of fir, dressed on four sides laid on edge lengthwise, and nailed together with 6 in. steel wire nails spaced two feet apart. These rest on steel trusses, with a covering of one-quarter inch hair felt, completed with a layer of Johns Manville Asbestos roofing. The walls and pilasters, both inside and out, are neatly finished off with a cement plaster containing an approved waterproofing agent, finally finished up with a wash of neat cement. Below the switchboard gallery is a spacious room for the superintendent's office, rheostat room, and bathroom containing white enamel bath, toilet and wash basin, for the use of the engineers when coming off duty. After the installation of the 500 h.p. oil engine this coming fall, the floors will be tiled and the walls painted. Underwriters' doors and windows are used throughout, making the building fireproof in every detail. All the interior wiring is run in loricated conduit which was imbedded in the concrete during erection.

Light and Power

The street lighting system consists of 72-7½ amp. enclosed arcs, and 80-100 watt series tungsten lamps. Plans for the erection of ornamental cluster light standards for the principal avenues are now being made.

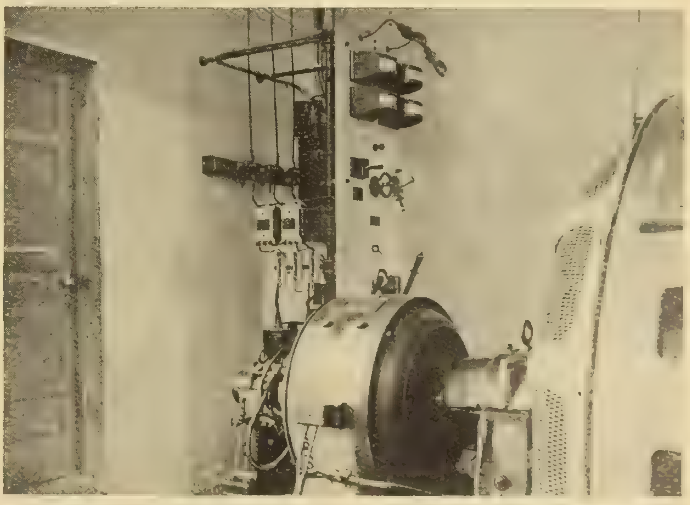
The power rates are—a definite fixed charge of $1 per h.p. per month of maximum demand, to be determined by watt meter tests at least every six months, under maximum working conditions of the motor, and, in addition to the fixed charge, the actual energy consumed to be charged for at these rates:—First 100 kw. hours at 05c per kw. hour; 101 to 200 kw. hours at 04c per kw. hour; 201 to 500 kw. hours at 03½c per kw. hour; 501 to 1000 kw. hours at 03c per kw. hour; 1001 to 2000 kw. hours at 02½c per kw. hour; 2001 kw.h. and over at 02c per kw.hour; all less 10 per cent. if paid within 10 days.

The light rates are—10c per kw. hour, less 20 per cent. if paid within 10 days, which is practically 8c. Maximum charge $1.25 per month including meter rent. Power rates are granted to consumers using electrically operated domestic conveniences, when a separate circuit and meter is installed.

A Neat Saskatchewan Plant

Canora also instals a Gas-Electric Unit—Local Isolated Plants closing down—Modern Street Lights.

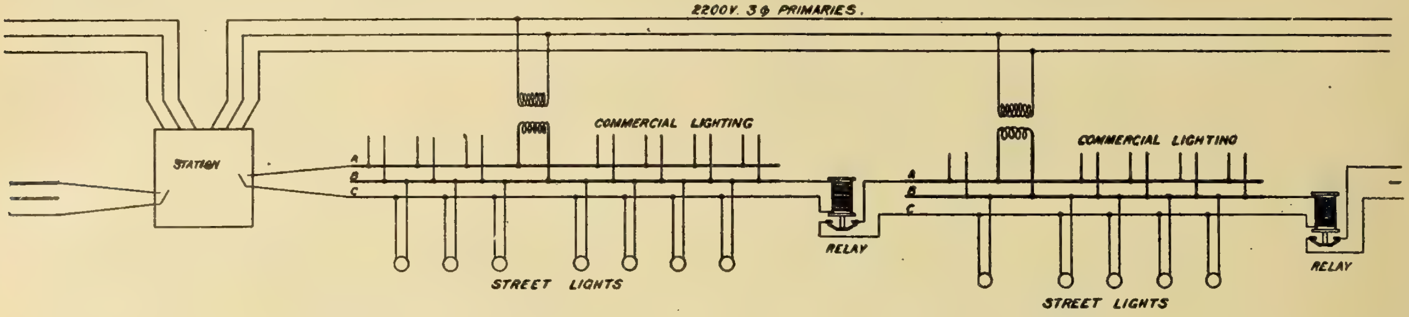
Within the past two months there has been completed at Canora, Sask., the installation of an electric light plant. The increasing demand of towns in the west for the comforts of civilization, added to the keen competition between the various municipalities has caused and is causing great struggles for civic improvements in order to attract settlers, manufacturers and merchants, etc., to find better attractions in one particular town than any other. Almost the first improvement of any importance is the introduction of electric lighting, and often in small towns hotel keepers have found it a necessary commodity and have therefore installed small battery sets. (In this town the two biggest hotels had plants of their own but as would be expected they are now connected to the municipal plant). It is then to be anticipated that great strides will be made in the number of municipal plants in the near future owing to the rapidity with which the population of the west is increasing and highly important that the



Switchboard, exciter and generator, Canora.

people get competent engineers to advise them as to the best system to adopt for their individual cases and so prevent the various municipalities from entering into an unprofitable undertaking.

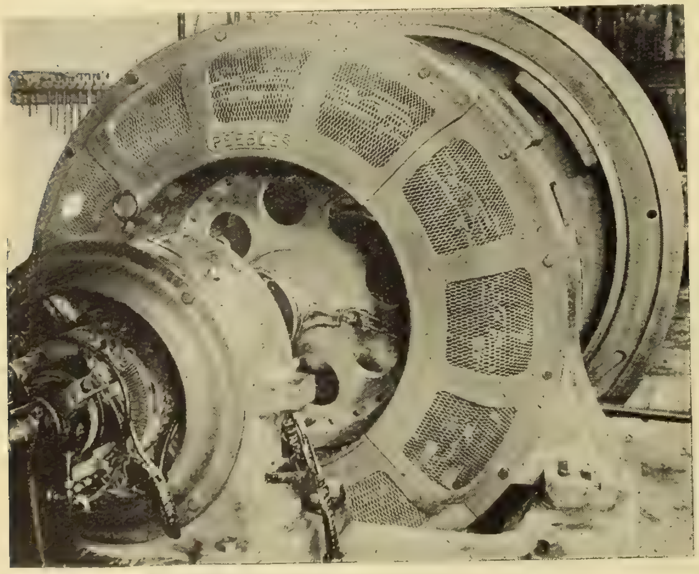
The town of Canora recognizing that they had reached a point at which they would benefit by the addition of an electric light plant, employed the services of consulting engineers to prepare reports on systems using as prime movers (1) steam engine; (2) gas engine; (3) oil engine; the engineers being instructed to take into account the capital expenditure, maintenance costs, depreciation, etc., of each system. The engineers appointed were Messrs. Bowring & Logan, of Winnipeg, and acting under their advice the council decided to install a crude oil engine of the Diesel type as prime mover. The low cost of crude oil, low standing charges of the plant, the easy operation, and reliability of this engine, entered into consideration in deciding upon installing the installation of this prime mover.



Plan showing distribution system adopted for Canora's street lighting.

The town having decided on going ahead with the work, also determined that no reasonable expense should be spared. The complete plant includes a new building, engine, generator and exciter, switchboard and auxiliary apparatus and a pole line.

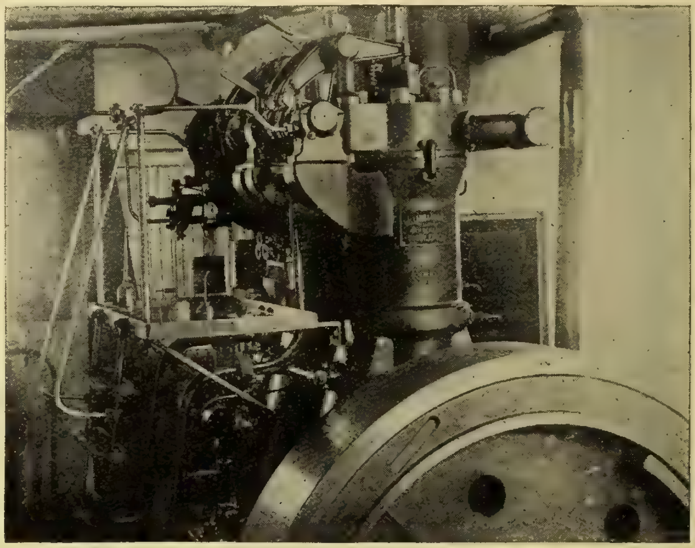
The building includes (1) space for a pressure system of fire protection already installed; (2) Fire Hall for hose reels and chemical fire engine; (3) room for firemen's quarters; (4) hose drying tower, and (5) space for future unit (to be used for municipal offices temporarily). In few towns would a building be found which would present such a handsome and solid appearance, its construction being practically fireproof. The walls are of red brick and the roof is covered with Rubberoid Roofing. Owing to the close proximity of a well of 25 feet diameter to one wall of the building, the whole of this wall is carried on a reinforced concrete beam supported at four points on solidly built piers. The maximum span between two piers is 20 ft. and 1¼ in. round steel was used for reinforcing. The nature of the ground and the presence of a layer of quicksand made it of the utmost importance that great care be taken to insure good foundations and good footings. The latter being placed on blue clay.



End view showing exciter and generator.

The engine, generator and exciter was purchased from the Northwestern Electric Company, of Regina, Sask. It is a direct connected set of compact and neat design, made up of a Willans two cylinder Diesel engine, Bruce Peebles generator and exciter rated as follows:—engine 100 h.p., 240 r.p.m.; generator 63 kw., 2200 volts, 3-phase, 60 cycle, 240 r.p.m.; exciter 30-80 volts, 20 amps., 240 r.p.m.

The engine is connected to a filter which is in turn connected to a 200 gal. reservoir situate in the building, and thence through a hand pump to the main reservoir outside the building. The oil is fed by gravity from the 200 gal. tank to the filter and then to the engine. A small quantity of coal oil is kept in a separate compartment of the filter and used for starting purposes and also for about five minutes before shutting down the engine. This is not absolutely necessary, but is advisable in order to clean the cylinders.



Engine and large fly wheel, Canora, Sask.

To most readers the operation of a Diesel engine is well-known, but as the machine is likely to be of importance in generating plants of the future it may be well to give a brief description of it. The engine is a four cycle engine and is nearer to the ideal Carnot cycle than any type known. On the first down stroke air is drawn into the cylinder and during the second stroke the air is subjected to compression of a very high degree and is therefore heated to a high temperature. On the third stroke, immediately after the piston has started in the downward direction, crude oil is sprayed in and is evaporated and ignited by the high temperature of the compressed air and not by any other means. The fourth stroke of the engine is upward and the burnt gases are exhausted. It is therefore apparent that in a two cylinder engine there is one explosion to every revolution. In order to force the crude oil into the cylinder a small compressor, mounted on the main shaft of the engine is used and the pressure is so regulated as to be well above the cylinder compression thereby enabling the oil to be forced into the cylinder. This compressor is also used for pumping air into reservoirs, which air is used for starting purposes at a pressure of about 65 to 75 atmospheres.

The tests carried out at the completion of the installation speak well for the quality of the apparatus and is highly creditable to the manufacturers The figures given below show well the low running costs as regards fuel as crude oil is bought at 13c a gallon F.O.B. Canora. They also show that the actual consumption comes well within the guaranteed figures.

Consumption in lbs. of Oil per B.h.p.

	Actual	Guaranteed
Full load per B.h.p.	.468	.494
Ten per cent. overload per B.h.p. .	.471	...
Half load per B.h.p.	.565	.599

Tests were also carried out on speed regulation and the governor worked in a highly satisfactory manner. The usual tests were made on the generator and exciter and the figures obtained were well within the guarantees.

The distribution system adopted was one which has been proved satisfactory in some eastern towns and is giving every satisfaction in Canora. The accompanying sketch, Fig. 4, shows the method adopted. The solenoid switches were supplied by the Electrical Repairs & Maintenance Company.

The street lighting has been highly commended by all who have seen it, and makes a bright and attractive town where before at nights the streets were all darkness. The main street is lit in the down-town section by lights on both sides of the street. These lights are placed on poles 90 yards apart, two lights of 60 watts each being located on each pole, one over the sidewalk and one over the road. The upper portion of the main street is similarly lighted but the poles are on one side of the street only. The side streets are lit with 100 watt lamps placed about 150 yards apart. All the lights are placed at least 13 ft. 6 in. above the ground and give a really good and efficient illumination.

The work from start to finish was carried out at Canora under the direction of Mr. G. H. Stevens, who was employed as resident engineer for the work. It speaks well for both Mr. Stevens and his employers that since the starting up of the plant, there has not been the slightest hitch in its running nor any shut down.

In addition to equipment already mentioned, other orders for various supplies were placed as follows:—meters, Chamberlain & Hookham Meter Company; transformers, Packard Electric Company; line material, Northern Electric & Manufacturing Company; switchboard, Can. General Electric Co.

The Western Canada Power Company, Vancouver, whose contract with the British Columbia Electric Railway for the supply of power was announced some time ago, have placed the contract for two 13,000 h.p. double Francis turbines with Messrs. Escher Wyss & Company, Montreal; these units to be installed at an early date. The same company will supply two inlet drum gates. The dam at Stave Falls will be raised to elevation 240 feet so as to create additional storage capacity in the Stave River and the Stave Lake.

Saskatoon's Steam Plant

New Power House—3500 Kilowatts in Generator Capacity—Fully Equipped Boiler Room

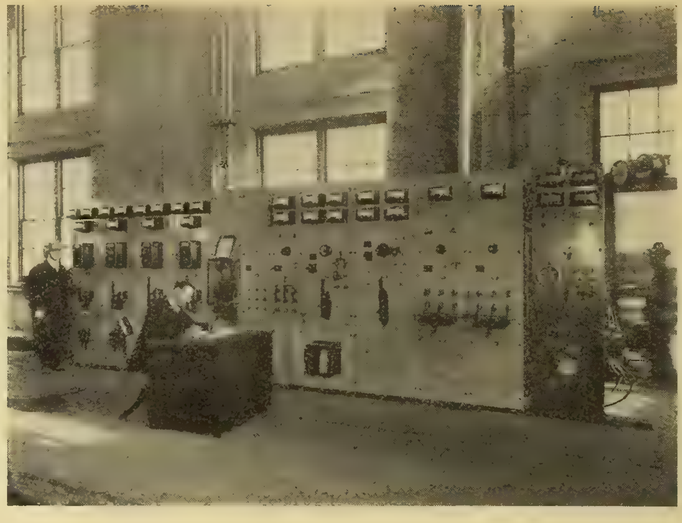
The illustrations herewith show typical views of Saskatoon's new power house and power generating equipment. The capacity of the generating equipment is now approximately 3500 kilowatts. This is contained in a new brick and steel power house 150 ft. by 80 ft, 40 ft. in height, which the city has just completed. The power house is divided into two parts by a brick partition, one part 100 ft. by 80 ft. for the boilers, and the other part 50 ft. by 80 ft. for the engines and generators. Underneath the engine and generating room is a 10-ft. basement for condensers, conductors, etc. A 10-ton travelling crane is installed overhead.

Saskatoon Municipal Power House.

The equipment at present installed is as follows: one 2000-kw., 2300 volt, 2-phase, 60 cycle, 18 r.p.m. generator direct-connected to a reactive type, 3-stage Parsons steam turbine with an overload capacity of 25 per cent. for twenty-four hours, supplied by the Allis-Chalmers Company of Milwaukee; one 937 kv.a., 2300 volt, 2-phase, 60 cycle, 150 r.p.m.

Interior View Saskatoon Power House.

Engine room during construction, Saskatoon.



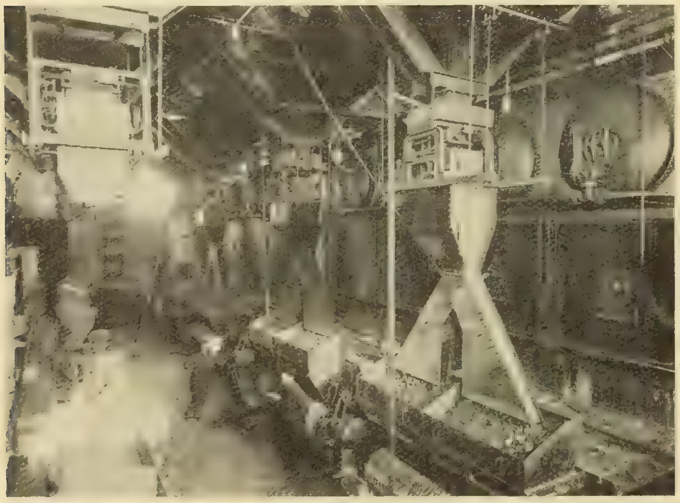
Main switchboard, twelve panels, Saskatoon.

C.G.E. generator direct-connected to a Robb vertical cross-compound engine and one 500 kw., 2300 volt, 2-phase, 60 cycle, 150 r.p.m. Allis-Chalmers-Bullock generator direct-connected to a Robb cross-compound engine. The exciters are two 75-kw., 125 volt, 2400 r.p.m. Allis-Chalmers type direct-connected to Parsons steam turbines, and one 40-kw., 125 volt, 300 r.p.m. C.G.E. type direct-connected to a Robb engine.

The street railway is served by two 300-kw., 600 volt, 600 r.p.m. direct current generators, direct-connected to two 2300 volt, 3-phase, 60 cycle synchronous motors.

The main switchboard shown herewith consists of twelve panels as follows, from left to right of the figure; four feeder panels; one panel for Tyrrill regulator; one blank exciter regulator; one panel for 40 kw. exciter; one panel for 937 kv.a. generator; one panel for 2000 kw. generator; two panels for the 75 kw. exciters; one panel for a curve drawing wattmeter.

The street railway switchboard has five panels as follows: one feeder panel, two direct current generator panels and two alternating current synchronous motor panels.



Equipped with automatic control, Saskatoon.

The main streets in Saskatoon are lighted by tungsten in five-light ornamental standards, but the outlying streets are supplied with arc equipment. These include two 50-light, 6.6 amp. magnetite sets and two 25-light, 6.6 amp. sets with a.c. series lamps.

The boiler room equipment consists of eight 500 h.p. Babcock & Wilcox boilers equipped with travelling grates, steam superheaters and Green fuel economizers, The coal is elevated from a bin beneath the railway cars by an endless belt to a coal bunker of 600 tons capacity situated over the boilers. From this point it feeds down to the hoppers of the travelling grates. Each boiler is equipped with an automatic coal weighing machine. There is also supplied a motor-driven ash conveyor to carry ashes away from the boilers as soon as they are dumped from the travelling grates. The coal and ashes are all handled automatically from the time the coal leaves the bins beneath the cars till the ashes are dumped outside the car house to be carted away. A forced draft is furnished by two motor-driven fans. There are also two engine-driven fans as auxiliaries.

The power house also contains two condenser pumps of 840 gallons capacity per minute under 40 ft. head driven by two 220 volt, 10 h.p. motors and two condenser pumps of 3500 gallon capacity under a 40 ft. head driven by two 220 volt, 25 h.p. motors.

The power house staff for each of the three shifts of eight hours includes one switchboard operator, one engineer, two oilers, one fireman. The cost of generating figures out at 2¼c per kw. hour at the switchboard. Soft coal costs $7 per ton F.O.B. the power house.

With the exception of a few run-offs the street railway was put into operation without a hitch and is proving very successful. The system in the near future will be extended to the town of Sutherland, two miles from the city. Sutherland has offered to build the line if the city will operate cars over it.

Waneta Development Company

According to a recent announcement made by Mr. David Walmsley, of Nelson, B.C., one of the directors of the Waneta Development Company, upwards of $75,000 will shortly be expended by the company on its proposed power plant at the junction of the Salmon and Pend d'Oreille rivers near Waneta, under a bond of $10,000 which has been deposited with the provincial government as a guarantee of good faith. It is understood that the plant will be of an initial 2500 horse-power development, and so constructed as to permit of future extensions. The plans of the company also include the construction of a power line to Sheep Creek, to supply the mines in that district, and possibly later an extension to Salmo. The project is backed by capital from the United States, but was originally mooted by the Pacific Exploration Company some years ago.

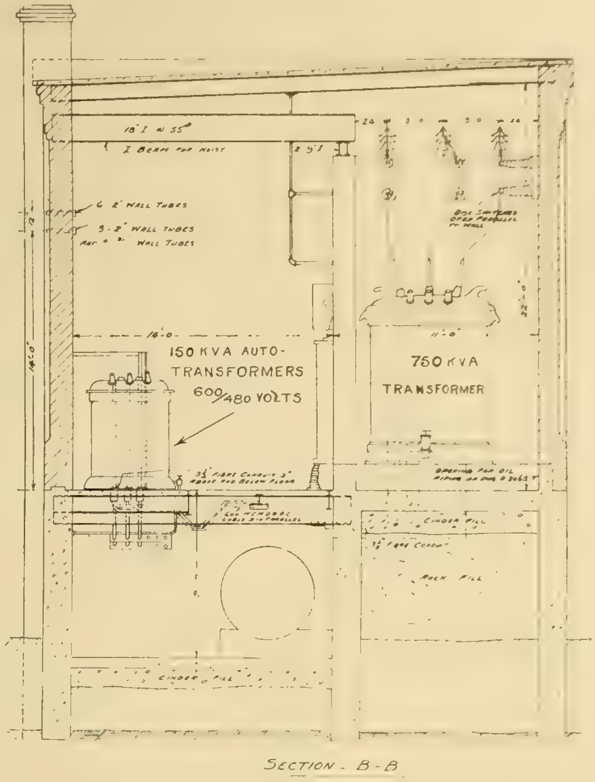
A Well Designed Sub-station

On the Electric Power Company's Line to Serve the Canada Cement Company, Belleville

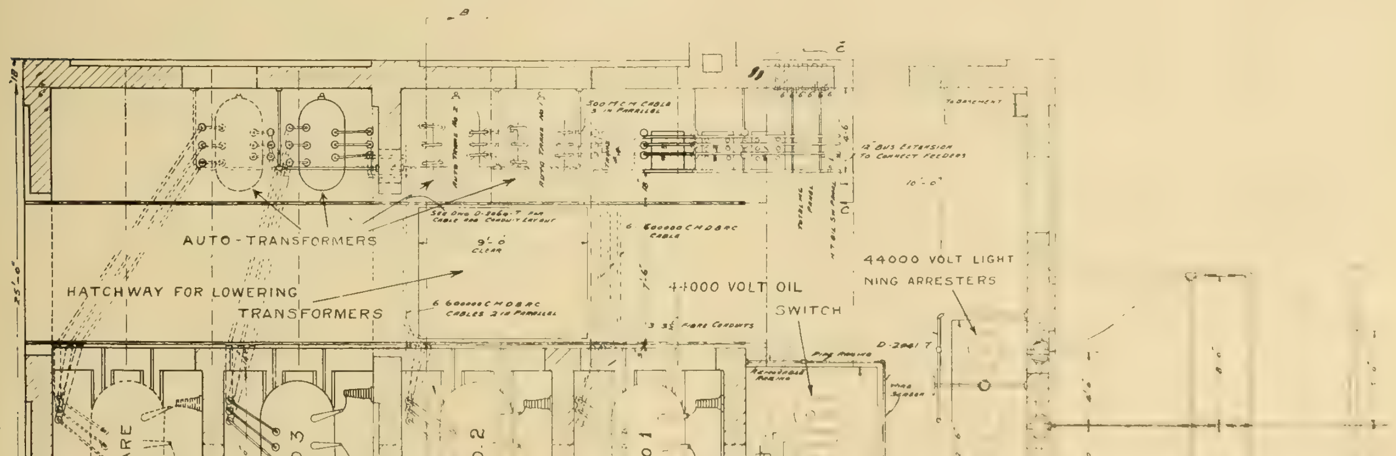
Owing to recent extensions and improvements in the Canada Cement Company's Belleville mill, they will require additional electric power to operate. For the past year and a half this mill has been driven electrically by power furnished by the Electric Power Company. About 1200 h.p. has been used, this being furnished through a sub-station stepping down from 44,000 to 480 volts, and located on the cement company's property. The sub-station as originally constructed contained 2-750 kv.a., 60-cycle, 3-phase, water-cooled transformers, ratio 44,000 to 600 volts, together with 2-750 kv.a., 3-phase auto-transformers, ratio 600 to 400 volts. This allows of the use of standard 750 kv.a., 3-phase transformers, as adopted by the Electric Power Company, there being now 18 similar transformers of this particular size on the system. These transformers have been furnished by the Canadian General Electric Company. The high tension windings are arranged for 44,000 volts, with taps for 42,000 40,000 and 38,000 volts. The low tension windings are arranged so as to be interchangeable for 600 and 2,400 volts, so as to feed directly to large mills or factories, using 550 volt motors, or into local distribution systems using 2,200 volt service transformers. For either the 600 volt or the 2,400 volt connection the low tension windings are delta connected. The 2,400 volt windings can be "Y" connected, and the neutral brought out, thus giving 4,160 volts, 4-wire, 3-phase, which method of distribution is already in use from several of the Electric Power Company's sub-stations, in the vicinity of which the load is sufficiently scattered to warrant the higher voltage for distribution.

The 4,160 volt, 3-phase, 4-wire system has some very distinct advantages for such work, in that it allows of the distribution of power, with a cost for distributing copper of hardly more than one-third the amount required for a 3-phase, 3-wire, 2,400 volt system, while at the same time standard light and power transformers wound for a primary voltage of 2,200 volts can be used, one side of the transformer being connected to the neutral. The radius of distribution from each sub-station is increased to such an extent that a smaller number of sub-stations are required on the system.

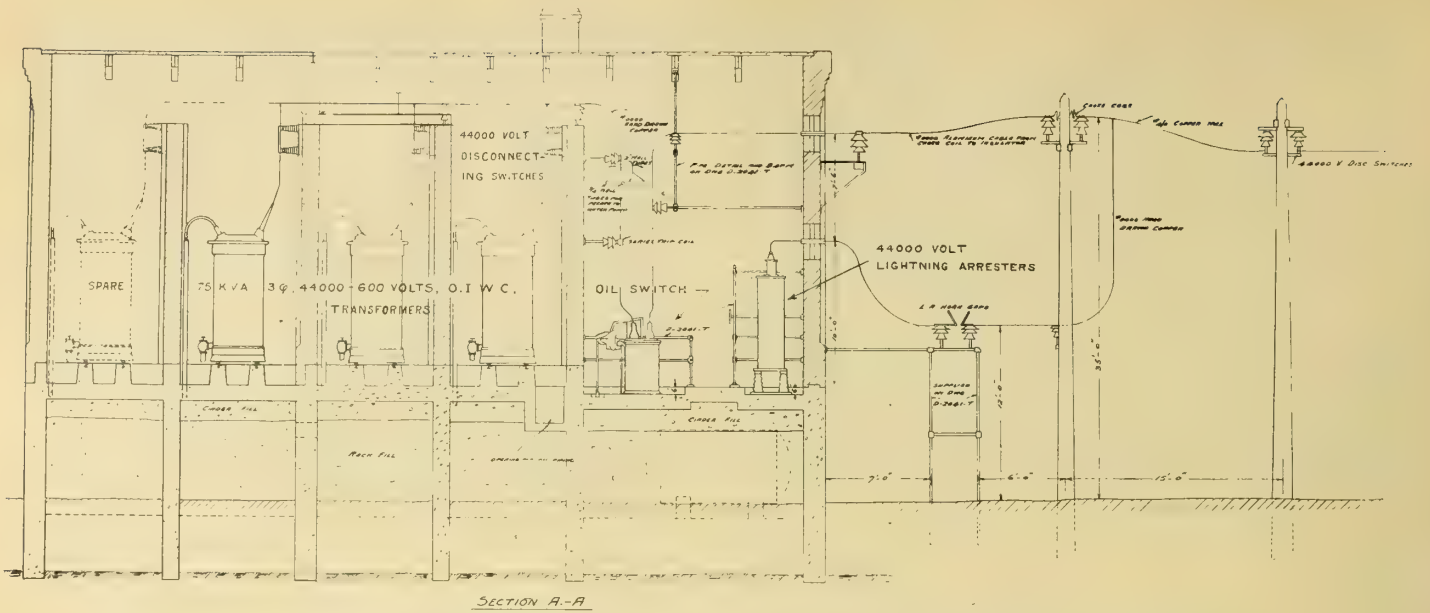
The auto-transformers for stepping down from 600 to 480 volts are considerably smaller and of lower cost than double winding transformers, and it was considered advisable to use them to supply power to the 440 volt motors in the cement mill rather than build special transformers to step down from 44,000 volts to the motor voltage. The power demand at this mill has recently been considerably increased, so that it has been necessary to build an addition to the sub-station and install a third 750 kv.a. transformer and an auto-transformer. The extensions to the sub-stations have been made in such a way that space is left for a fourth transformer, if such becomes necessary. The sub-station is also built in such a way that extensions can be made indefinitely



Section Belleville cement sub-station



Main floor plan Belleville sub-station of the Electric Power Company



Vertical cross-section Belleville sub-station, to serve the Canada Cement Company

for the installation of additional transformers. The building is of simple rectangular type, see drawings herewith, and in addition to the transformers and low tension switching equipment, it contains a 44,000 volt oil circuit breaker and an electrolytic lightning arrester, the horn gap and choke coils for which are mounted outside of the station. In order to dismantle a transformer for repairs it is lowered through a hatchway to the cellar, thus decreasing considerably the head room required in the station. An oil tank and oil pump are located in the basement, and will take care of transformer oil during erection or repairs. The load now carried by this sub-station is in the neighborhood of 2,000 h.p., and as usual with cement mill loads, the load factor is exceedingly high, as the mill operates 24 hours a day with fairly constant load. Pits are arranged below the transformers, so that in case of an escape of oil from any transformer it will be entirely confined to the pit of the transformer, from which it escapes. A good supply of water for cooling transformers was not readily available, therefore a wooden tank lined with galvanized iron and set of cooling trays was erected next to the sub-station. This, together with a 1½ in. motor driven turbine pump, provides cooling water for the transformers. A transformer transfer truck running on rails on the main floor of the station provides for the moving of the transformers.

Power Situation in Lethbridge

Valuable Report on the Relative Merits of Water Power, Gas Firing, Gas Engines and Coal

The report by Mr. R. A. Ross, consulting engineer, Montreal, on the power situation in Lethbridge, is valuable in its discussion of the relative merits of different forms of prime movers, applicable to that section of the country. Mr. Ross reported as follows:

The existing power conditions in the City of Lethbridge are, briefly, as follows:—population, 12,000; boiler horsepower, 2,280; generating equipment, 2,438 kw.; maximum peak for 1912, 1,000 kw.; night load, 200 kw.; daily load factor average per year, 30 to 32 per cent.; total customers, 1,500; cost of coal from municipal mine, $1.65; heat value of coal, B.T.U., 9,500; capital cost per kw. of station, including buildings, $128.

Looking over the station I found a first-class equipment, situated at the mouth of a mine producing a fair grade of coal, the whole indicating a plant from which the best economy should be expected, the only matter which would tend to reduce its inherent efficiency being the small amount of load carried as compared with the capacity of the plant. The surplus capacity at present unused is given by the 1,500 kw. turbine which has recently been added in anticipation of future growth, and although at the present time the equipment is largely in excess of present demands. I cannot but feel that the size of turbine unit adopted was wise in view of probable growth. The situation, therefore, is that at the present moment the production costs are burdened with the charges on the additional equipment necessary to provide for future growth, but which is not at the present time fully utilized.

Water Power

It has been suggested that power might be derived from the Belly River, at a point some distance from the present power station, where it is claimed that a damsite is possible.

In dealing with this question the records of the government show that the flow of the Belly River at the point falls as low as 120 feet per second. If, however, we consider a total of 200 feet as available and the possibility of obtaining a 50-foot head, which I understood is as high as can possibly be got, the total derived will only be 830 horse-power. What the conditions are during winter we do not know from government reports, as no records are taken, but the probability is that the flow is very low, indeed, at the time when your power requirements are greatest. It would appear, therefore, that in view of the cost and uncertainty of power obtained by the construction of an expensive dam across the river, it is not within the bounds of commercial possibility.

Gas Firing for Boilers

I understand that the price of 10,500 b.t.u. gas at Lethbridge is 15 cents per 1,000. For the purpose of boiler firing this is equivalent to 9,500 b.t.u. coal at 3.80. It will therefore be seen that there would be no advantage in using gas for this purpose when your coal only costs $1.65 per ton. If gas were adopted your investment in coal mine, bunkers, conveying machinery and stokers would be thrown away, and an additional investment of $500.00 per boiler would have to be made for gas-firing equipment, and little would be saved in the way of labor, as your coal is handled and fired by machinery at present.

Gas Engines

Consideration might be given to gas engines, provided your equipment were not already installed, and this purely on the basis of saving of fuel, as the capital cost of the gas engine equipment will be about the same as that of your present station per horse-power.

From some rough figures I have made it appears that under condition of a new plant being established, gas engines might be a serious competitor to your present equipment, even with coal at the low price which you pay, and it may be that improvements in gas engines or the development of the gas turbine may make it possible for you to make extensions in later years with gas engines, but, at the present time and under existing conditions, until your load has increased sufficiently to warrant additions, the gas engine equipment appears to be unacceptable.

Transmitted Power

It has been suggested that power could be generated at one of the coal mines adjacent to Lethbridge from slack coal, and transmitted to the city, at a cost to you less than you are generating at present, or may in future.

The only possible condition under which this seems probable would be that the coal mine had a very large equipment or electrical machinery for its own use, and really sold you the surplus power generated. It must not be forgotten in this connection that the only saving would be the coal, as in order to obtain the same results which you should obtain with your plant, the company would have to install apparatus of equal efficiency, which would cost as much to them as to you, viz., about $128 per kilowatt; in addition, they would have to provide a transmission line, possibly seven or eight miles long, over which the power would have to be transmitted at 6,600 or 12,000 volts, and a stepdown station and switching equipment provided by them to reduce to 2,200 volts for use in Lethbridge.

This would mean that their total capital investment would be higher than yours, and it would seem entirely probable that with the small amount of power used at present in Lethbridge and the low factor which you have that the saving in fuel, if it cost nothing at the mouth of the mine, would be eaten up by fixed charges for line and transformer equipment and their necessary attendance, repairs, etc.

However, of the bare possibility that a less rate might be obtained from the source than it is costing you at present, it might be advisable to enter into negotiations with these companies, sending them a maximum load curve of your station for last year and also a minimum summer load curve, explaining that power should be delivered to you at 2,300 volts on your switchboard at Lethbridge to render a comparison possible, and intimating that the loads from your past experience might be expected to increase at a certain rate per year.

Suggested Procedure

As will be seen by the above, I am of the opinion that with the equipment at present installed, and the fact that coal can be had cheaply, practically at the door of the power house, it is very improbable at the present time that you can devise any other means of obtaining power as cheaply as with your present equipment, but that the best results in your plant will not be obtained until your loads are very largely increased.

I submit herewith a load diagram corresponding roughly to your demand during December of last year. On this diagram I have cross-hatched the area representing the output during peak load of the year, and have also indicated the safe capacity of the plant—in other words, the load in kilowatts which you could safely sell, considering that if one or other of your small engines is broken down, the remaining equipment can be operated, as it easily may be, for a short time at 25 per cent. overload. From the figures on this diagram you will see that the output of your plant in kilowatt hours, at 30 per cent. load factor, is only 13.6 per cent. of the total which might be possible under a 100 per cent. load factor. You have, therefore, represented in the large unhatched space the possible additional output, and while it is not possible to obtain this load factor under practical conditions, there is evidently a large field for the sale of additional power without any increase in your plant for some time.

I would therefore strongly suggest that all possible means be adopted to increase your load factor, and to fill up the hollows in the curve by pushing the sales of electrical devices and the sale of power off-peak. This is a commercial condition which confronts every electrical manager, and, generally speaking, the question whether dividends are paid or not depends upon his ability in utilizing to the fullest extent the possible output of the plant by the sale of power when it is not in demand at the peak of the load for lighting.

We understand your greatest desire is to encourage the establishment of industries in Lethbridge, the object being the attainment of population. I would point out in this connection that smaller manufacturers, where a large number of men are employed and a smaller amount of power used, are of more importance than the larger industries, where more power is used and fewer men engaged.

At the present time you will note that you might sell an additional 1,200 kw. over 24 hours per day without encroaching on your peak and also an additional amount of off-peak power represented by the un-hatched portions below the 1,000 kilowatt line. The cost of this power, if it could be sold, would be only the cost of coal, the question of fixed charges on additional plant not having to be met, and, owing to the fact that your boilers are mechanically fired and the coal is also handled in the same way, your labor charges would be increased but slightly, if at all.

Under these conditions, with your economical plant loaded up to its full capacity and, therefore, consuming only about half the coal per horse power, at present, you could generate this excess power for 24 hours per day and 365 days in the year for about $22 per horse power year, and for 70 hours per week and 52 weeks in the year $10 per horse power year at your power house terminals, with coal at $1.65 per ton.

It must be remembered, however, in this connection, that if this be done and power be sold over the peak of the load that you will have to later increase your plant to take future peaks and will, in effect, therefore, in future be saddling all the fixed charges of your entire plant on the peak load, from the charges which they are entitled to share with others. If, however, you sell your additional capacity to power consumers, whose power will not appear on the peak of your load, the extra cost involved is practically only the cost of coal as above, and no criticism can arise on the point of fixed charges not being properly placed.

Summing Up

Summing up the above, it appears that:

(1) You have a modern equipment fully capable of dealing with your demands for some time.

(2) That the amount of power derivable from the Belly River is too small and uncertain and expensive for your purposes.

(3) That gas firing of your boilers will be more expensive than coal at present prices.

(4) That the possibility of gas engine use lies in the future, when your present plant requires extensions.

(5) That in view of possibilities it might be well to obtain tenders upon power delivered from a coal mine.

(6) That as you have by no means developed the possibilities of the plant you have, attention should be concentrated on obtaining a greater load, especially of off-peak power, for which very low rates should be given.

Electric Hoists in Mining Operations

Many Applications of Electricity to Mines—The Use of Hoists Becoming General—Three Main Systems Explained

By Mr. C. H. Wright

Mining engineers have long recognized that electric drive and distribution affords advantages superior to all other systems. For lighting, pumping, and surface operations there have been a large number of electrical applications. In coal mines, however, the largest motors would be those driving the electric hoists, but electric coal hoisting on any large scale has only recently come into use in this country. Steam hoisting is much more common even in those mines where electric motors are used for almost any other class of work. There are a number of mines using electric motors for conveyors, fans and pumps that have until recently been using compressed air for haulage, or a motor on the surface with an endless haulage system. Electric hoists show a saving because the steam generating plant may be centralized and high pressure steam may be produced with an economy that could not be thought of in numerous small boiler plants which would operate on fluctuating loads with lower pressure and without superheat; these small plants could not use advantageously modern methods of stoking, coal handling, and improved combustion. By combining these smaller stations high pressure steam can be used with superheat and low vacuum suitable for a turbo generator of large size; their load then becomes more even and of a size suited to this large equipment; whereas, in the case of numerous small steam hoist stations a large reserve is necessary at each station—the loads fluctuate, lower pressure and poor vacuum are encountered, all of which tend to poor economy.

An electric power, due to its rotary motion, has splendid torque characteristics. The power is uniformly applied throughout the operating cycle as there are no reciprocating motions or intervening connecting rods or cranks with varying torque in each position. The power demand is limited to the time during which the hoist is in actual operation. This minimizes the actual power consumption and under some conditions power may be returned to the line from the descending cars. This calls for a design specially suited to the conditions. In steam hoisting care is necessary when starting after a long stop to avoid cracking the cylinders due to uneven expansion and to water accumulating in the cylinder. Where electric hoisting is adopted exhaust steam can be used in the turbo generators—this exhaust being sometimes otherwise wasted. Where such conditions demand, electric hoist dimensions can be made very small indeed. The flexibility of control is obvious, and the cost of attendance is lower.

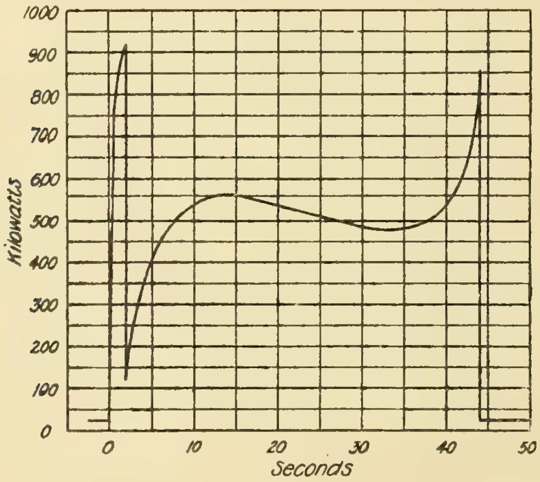


Fig. 1

For long distance transmission alternating current is generally used, and this may be applied directly to the hoisting drum through an induction motor. This induction motor may be either of the line voltage, or as is usually the case, of a lower voltage obtained through step-down transformers. Where better speed control is required, or where a direct current circuit is available, a direct current motor is sometimes preferred to the induction motor. Very efficient and refined speed control can be obtained from such an equipment. The induction motor is a simpler and more rugged device but does not lend itself so readily to varying speeds.

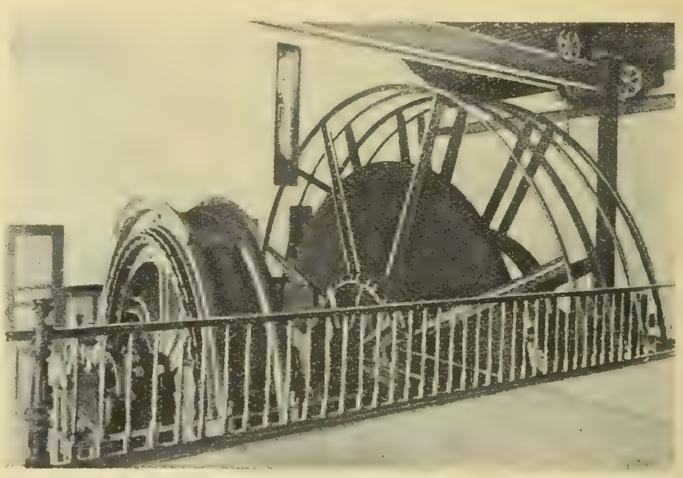


Fig. 2

It sometimes happens that on account of water conditions it is impossible to use pumps to unwater the mines, and a water hoist is sometimes used with a balanced bucket system, the buckets rising and falling, one emptying while the other fills. Such a bucket system overcomes trouble with acid or gritty water, but has a varying power demand. Fig. 1 shows the current consumption for one complete operation when the bucket is lifted, stopped and discharged. A steam hoisting proposition would not meet the requirements of such a case satisfactorily, but the electric drive is very satisfactory indeed. Occasionally buckets are raised and lowered by ordinary variable speed induction motors with rheostat control on the secondary; such motor would be geared to the cable drum, the entire equipment reversing to raise and lower the buckets. The more satisfactory arrangement, however, is to use a direct current motor, and if direct current is not available, then a motor-generator set is necessary to give the required power. If to the motor-generator set there is added a fly-wheel, the whole system has an inertia which makes for good regulation. Separate exciters should be provided, and the speed variation of the motor is obtained by field control of the generator. Such water hoists are in operation calling for powers over 800 horse-power. In order to obtain alternating current a synchronous motor-generator set is sometimes used and such an equipment may be designed to improve the power factor of the whole system, which with varying low loads often needs correction.

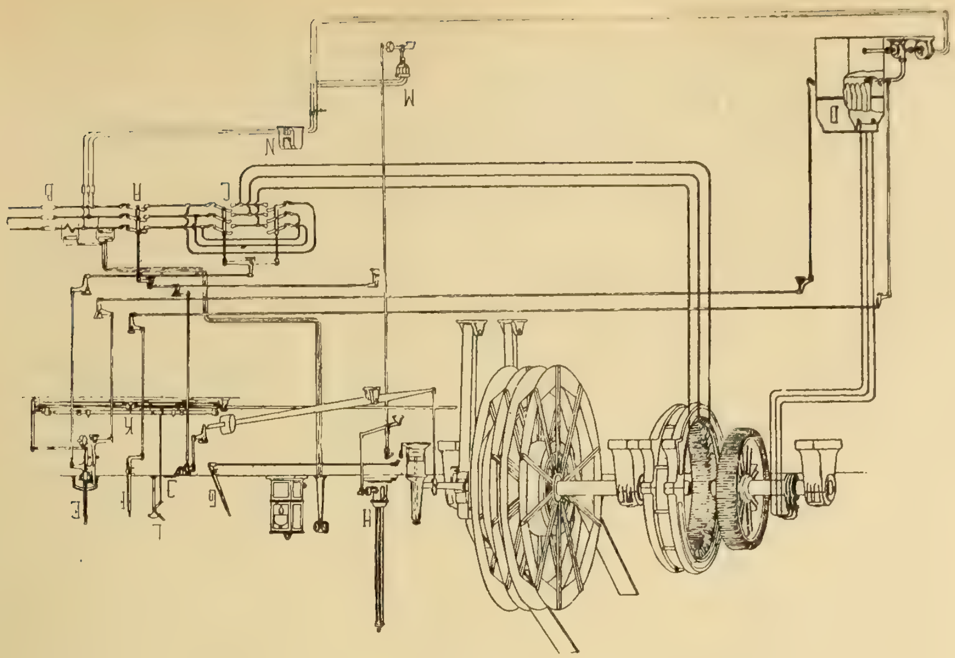


Fig. 3

The question of coal hoisting by electricity is a more serious problem but it has been faced in a number of our Canadian collieries. The Dominion Coal Co. is definitely committed to electric hoisting, having installed one such hoist, and having two more hoists on order. The Acadia Coal Company, Stellarton, Nova Scotia, have been using electric coal hoists for over a year.

There are three main systems of electric hoisting—(1) A phase wound alternating current motor taking comparatively high voltage current from the line or through transformers may be used; such motor would have rheostat control in the secondary using either liquid resistance or metal rheostat. If this motor were mounted directly on the drum shaft, it would be of low speed, and hence of comparatively low power factor and efficiency. Generally such motors are geared to improve the above conditions. An efficient Citreon gearing is sometimes used, and being accurately cut it brings the entire equipment up to normal efficiency. Rheostat control is not as economical as d.c. field control under many conditions. It may be the means of considerable loss if there are frequent starts. If the acceleration period is short as compared with the normal running period the case is different. This type of winding equipment is one of the best. A three-phase winding motor direct connected to the drum is shown in Fig. 2, and the diagram of connections for such an equipment is shown in Fig. 3. It is to be noted that such an equipment does not call for any motor-generator set or direct current apparatus; the expenses for winding equipment is, therefore, reduced to a minimum. The Dominion Coal Company, Glace Bay, will shortly install large winding plants driven by a.c. motors; and the Acadia Coal Company, Stellarton, are already using them.

(2) A second system of hoisting consists of a direct current motor mounted on the winding drum shaft and supplied with current from a motor-generator set which would take a.c. current at line voltage and deliver it to the winding motor at a pressure best suited to the design. Such a motor would have speed control by field variation using the Ward-Leonard system as in the case of the water hoist already described. This gives a more efficient method of speed variation. It defers the peak-load as desired within limits, and so eases the power house. A given position of the speed control lever indicates the certain speed of the rope, and under some conditions power may be returned to the line by the empty descending cars.

This a.c., d.c. equipment is more complicated and more expensive than the straight induction motor equipment but is much used in Europe and South Africa. A fly-wheel motor-generator set operates at practically a constant speed, and the fields of the generator are varied in strength by means of proper appliances; this gives a varying voltage to apply

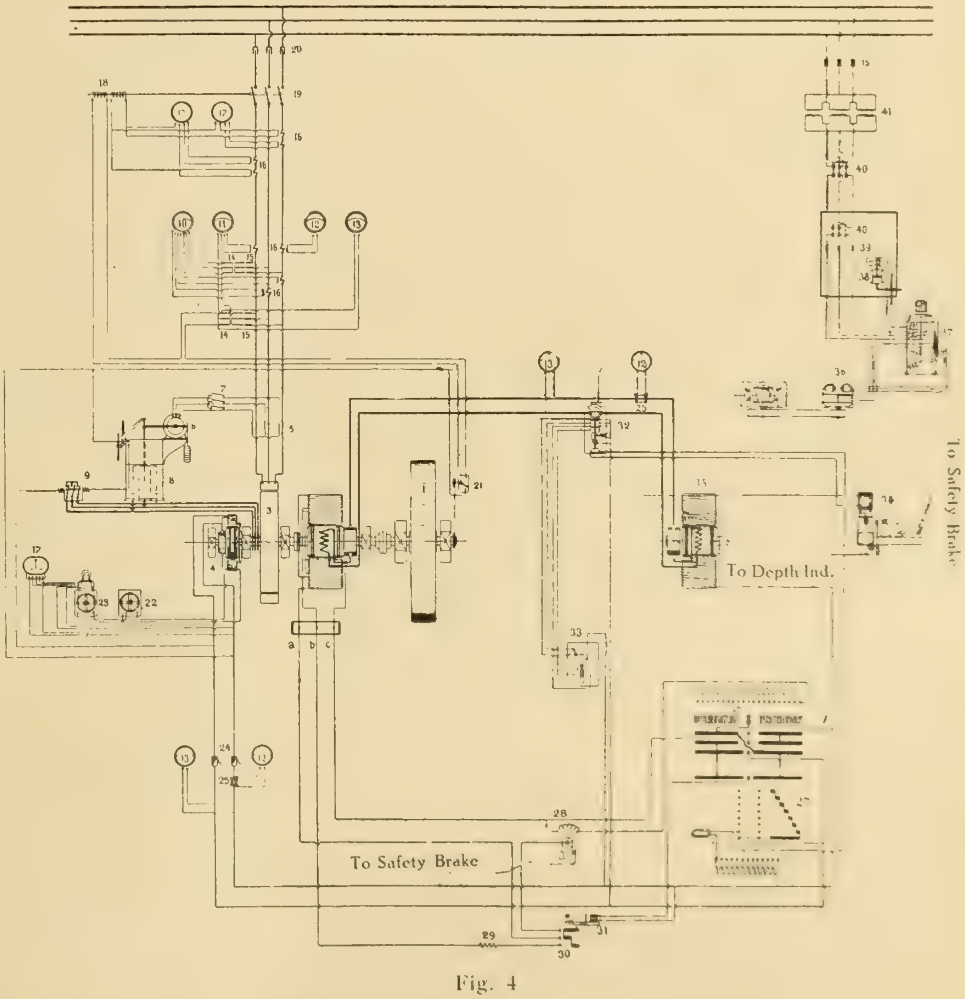


Fig. 4

to the winding motor. The finest of speed control is thereby obtained in the most efficient possible manner. A diagram of connections of such a system is shown in Fig. 4.

(3) The last system described is sometimes used without the fly-wheel effect, and the choice between these two is determined by the frequency and length of the acceleration period.

In some of our Canadian collieries motors of as high as 1600 h.p. are used in this class of work. Hoisting equipments of smaller power are comparatively common in the coal mining districts of Nova Scotia.

It might be of interest to add that practically all of the mining operations requiring power have had electrical applications in Canada. It is quite certain that these applications will be extended and developed in the near future. As regards such applications it is also pleasing to note that Canada is well in the fore-front of electrical developments.

A 900-Mile Telephone Talk

The Austrian telegraph administration recently decided to establish a telephone line connecting Vienna with Dalmatia. The line from Vienna follows a southerly course and passes over a number of islands in the Adriatic Sea to the coast of Dalmatia. The line therefore consists of both aerial and cable. The aerial line is of bronze wire, five mm. in diameter. The cable connecting the mainland and the islands has a total length of 60 km. (38 miles).

Considering the great distance between the terminal points, which was approximately 815 km. (510 miles), the principal difficulty was in the choice of a submarine cable. As gutta-percha cables of the ordinary construction are not suitable for telephone work there were only two constructions, which in principle are totally different from each other, namely, the Pupin and the Krarup systems, that is either a cable with self-induction inserted at certain definite points or distributed uniformly over the whole length. It was finally decided that for the telephone line in question the construction of the cable on the Krarup system would be most suitable.

The cables contain four cores, the construction of each core being as follows: The copper strand consists of a central copper wire surrounded by three flat tapes and has a sectional area of about 5.5 square mm. in all. This copper strand is closely wound with three layers of soft iron wire, .2 mm. in diameter, and is insulated with guttapercha of a special quality to a diameter of 8.4 mm. To minimize the "leakance," a special gutterpercha mixture was chosen which, according to test, was found specially adapted for the purpose. The cores are laid together in pairs and the two pairs are again stranded. The four cores are finally served with brass tape as a protection against the teredo. The main cable is sheathed with twenty-four galvanized iron wires of 5.7 mm. diameter and the shore end with twenty such wires of 7.1 mm. diameter. The laying of these cables was carried out in much the same way as is the laying of telegraph cables. A cargo steamer was equipped with the necessary machinery and the work of laying carried out without difficulty.

After having made the permanent connection between the cable and the aerial line the speaking trials which were made from Zara with the terminal station at Vienna gave excellent results. The tone was loud and the articulation very clear, distinct and well-maintained in spite of the great length of cable. An abnormal leakage from the aerial line is prevalent in this district, caused chiefly by the insulators and iron brackets becoming covered with a thick precipitation of salt which is deposited at times to a depth of ½ inch. For this reason a line loaded with higher self-induction would have been of less advantage.

"Cross talking" such as is sometimes met with in telephone cables was not noticeable with the cable supplied. Further experiments have proved also that both pairs of cores are entirely free from induction.

Further extensions of the line have recently been completed and speaking trials have been carried out between Vienna and Sarajewo, a distance of about 900 miles.

Previous to the laying of the telephone cables described above, speaking trials were made to determine to what extent the volume of sound and the tone of voice would be altered when both pairs of cores were connected in series, thus giving a cable 120 km. in length. Even over this length of cable which was further connected in series with about 500 miles of aerial line the trials are reported to have proven entirely satisfactory.

This cable was manufactured and installed by Messrs. Norddeutsche Seekabelwerke, Aktiengesellschaft, Nordenham, whose agents in Canada are Watson Jack & Company, of Montreal.

Rapid Telephone Growth

At the end of 1911 there were, by official count, 16,160 telephones in use within the city of Vancouver, and that number was increased to 20,752 on December 1, 1912. So rapidly has the Vancouver system developed that it has been necessary to handle city business through four exchanges, and another is soon to be opened in one of the near-by suburbs. A large part of the telephone business of Vancouver is done through the long distance exchanges of the system. Calls to out-of-town points to the number of 38,914 originate in Vancouver every month, and thirty-two employees devote all their time to the operation of long distance exchanges. This service has recently been improved by the installation of a new submarine cable between Vancouver and North Vancouver, on the north shore of Burrard Inlet. The cable is made up of fifty pairs of 87 circuits, paper insulated, lead covered, and steel-wire armoured. It is the second largest telephone cable in use on the continent. In addition to this work a new cable forty miles long is shortly to be laid from Vancouver to Nanaimo on Vancouver Island, and there will be many additions and extensions to switchboards and buildings during the present year.

Fredericton, N.B. Notes

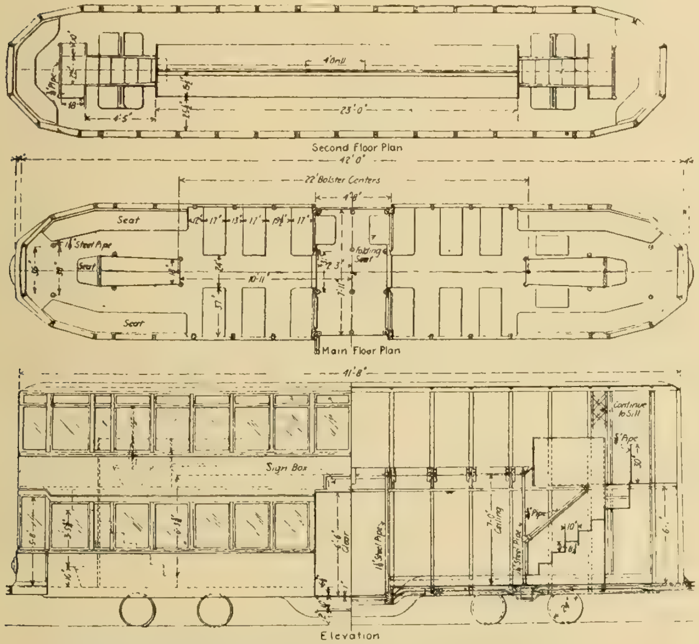
The Public Utilities Commission held a session in St. John on March 25th with reference to rates to be charged by the New Brunswick Telephone Company throughout the province. In towns using 2,000 phones and upwards, the business rate will be $45; residence, $30; two party business, $40; two party residence, $24; four party business, $33; four party residence, $20; eight party residence, $18; rural line business, $24; rural line residence, $18. In towns using 400 phones and upwards, business rate is $30; residence, $25; two party business, $25; residence, $20; four party business, $22; residence, $18; eight party residence, $15; rural line business, $21; residence, $18. 100 phones and upwards, business, $25; residence, $20; four party business, $20; eight party residence, $15; rural line business, $18; residenve, $15. Town systems less than 100 phones, business, $21; residence, $18; two party business, $20; eight party business, $18; residence, $15; rural business, $18; residence, $15. Less than 100 phones in sparsely settled districts, business, $21; residence, $18; two party business, $20; eight party business, $18; residence, $15. The schedule of long distance toll rates is 10c up to 10 miles, 15c up to 15 miles, 20c up to 20 miles, 25c up to 40 miles, 30c up to 50 miles, 35c up to 60 miles, etc.

ELECTRIC RAILWAYS

Double-Deck Car for Washington

A double-deck car, illustrated herewith, and combining several of the features of two designs brought out last summer, is now in course of construction for the Washington Railway & Electric Company, and is described in a current issue of the Electric Railway Journal. The new car embodies several radically new features, most prominent among which is the girder construction of the whole side of the car from side sill to eaves. A center entrance is used and the stairways to the upper deck are at the ends of the car. The height is reduced by the use of 24-inch wheels with small motors to suit.

The car is being built for experimental purposes and it is to be used in different classes of service in the city of Washington to give it a thorough trial. It is being tried with the idea of getting more carrying capacity per unit and per mile of track, as there are some portions of the city where the tracks are very congested during certain hours of the day. The company believes that double-deck cars may improve the existing conditions, and if its use is found practicable under the local conditions more cars of the type will be purchased.



The design is somewhat along the general lines of the company's center-entrance cars. Two stairways will lead from the center of each end of the car to the second floor. These stairways will be constructed with a platform two steps below the upper floor level and at that point will turn to the right and left for the final rise up to the second-floor level.

The car will seat 100 passengers, fifty seats being provided on each of the two floors. On the first floor the seats will be transverse except for a short distance near the ends alongside of the stairways where longitudinal seats will be installed. The seats on the second floor will be set longitudinally back to back. On each side of the stair walls transverse seats, each seating one person, will be provided, so that all of the available space of the upper deck will be used for seats.

The car will be 42 feet over all and have a width over sills of 8 ft. 6 in. The extreme height will be 15 ft. 3 in. and the first floor will have a clear standing height of 6 ft. 1 in. Access to the car will be effected through a wide center-entrance doorway for which folding doors will be provided. These doors will be operated manually and fold up into two sections at each side of the opening. The floor at the center of the car will be depressed to form a well and this will permit the use of very low steps to the ground level. As shown in the accompanying line cut, space for the motorman will be provided in front of the stairway and no separate cab will be installed for him.

The electric equipment will consist of four G. E. No. 236 motors. These are of a special design and have a capacity of 32 h.p. each. They will be mounted on specially designed trucks of the inside-hung type, all wheels being 24 inches in diameter.

The most radically new feature of the construction is that the sheathing for both the upper and lower decks will be made of steel plate. At the ends of the car, in the position which would ordinarily be taken by the corner posts of a standard car, latticed steel columns will be used rigidly framed into the steel sheathing of both decks and connected also to the plate at the eaves. This construction permits the whole side of the car from side sill to roof to assist, by its action as a girder, in supporting the weight of the car and its load.

Montreal Tramways

In view of the public agitation against the service of the Montreal Tramways Company, the company have drawn up plans which, if agreed to by the Council, will involve the expenditure of between $8,000,000 and $10,000,000. The directors are prepared to enter into a new contract, but they must be granted they say new routes if the congestion is to be remedied. It will be necessary to order 200 cars in addition to those now being built. Mr. Robert, the president, makes eleven suggestions, which include double tracking and the building of subways under the Lachine Canal. He says the company are prepared to discuss the opening up of Vitre street, the extension of the Guy and Beaver Hall line, the straightening out of Guy street, the opening up of Sherbrooke street, the extension of the Beaver Hall line to St. Lawrence Boulevard, the granting of new rules to the northern side of the city, the extension of the Papineau avenue line, the opening up of William street, the construction of subways under the Grand Trunk Railway at various points, and the opening up of Decarie avenue, Notre Dame de Grace, to the back of the mountain.

Mr. Duncan McDonald, former manager of the company, has also, at the instance of a Montreal paper, made an exhaustive report on the situation. He recommends the construction of a subway and the opening of seven new routes. In addition to this, he suggests schemes for the avoidance of congestion, and a long list of improvements to existing lines as well as for minor routes in various parts of the city. In his view most of the new routes suggested to take care of overloading in the northern part of the city and other troubles can be put into operation at very early dates. Mr. McDonald closes his report by expressing the opinion that subway operation is the most practical, effective, and profitable means of handling traffic in large cities, and that in the very near future the traffic of Montreal must be handled by the operation of subway trains.

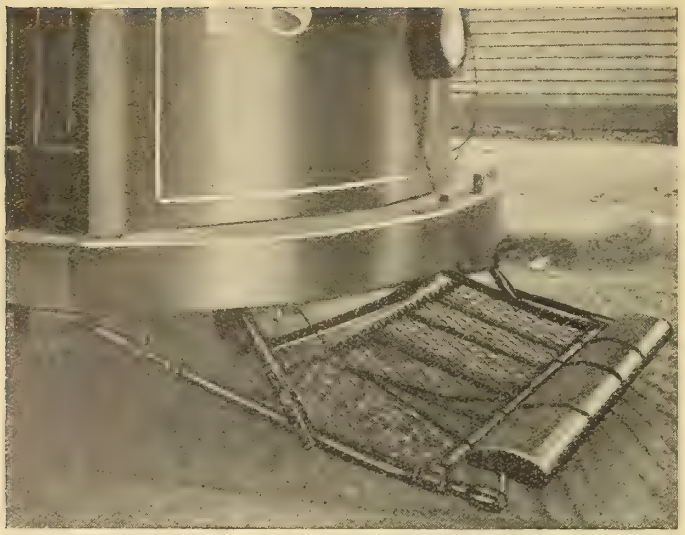


Fig. 1

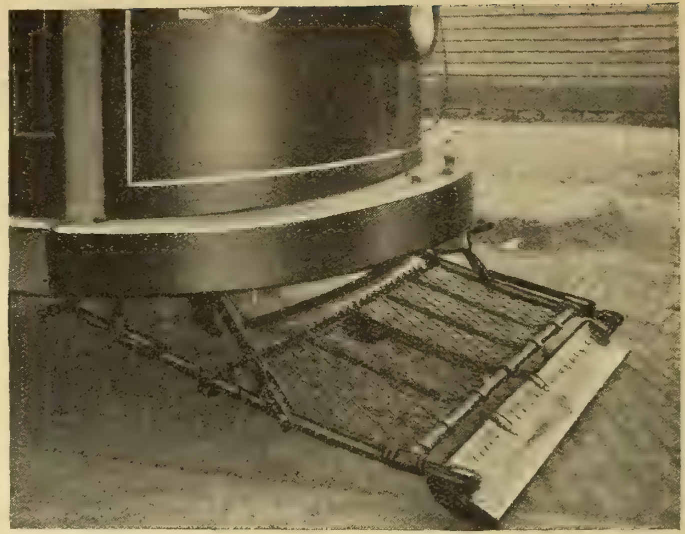


Fig. 2

New Type of Fender

A new type of projecting fender possessing a number of unique features has just been placed on the market by the Fonger Fender Company. The illustrations given herewith show the fender in different positions, viz.: Fig. 1, the normal or projecting position of the fender; fig. 2. the scooping position of the fender; fig. 3, showing swinging position of fender, and fig. 4, showing fender folded in a practically concealed position.

The most unusual feature of this new fender is a tilting shield at the lower end of the baskets which, upon coming in contact with any object on the track, automatically turns forward and serves as a scoop, fig. 2, in picking up the object encountered. In its operating position the fender projects less than 2 feet beyond the bumper and it is so attached to the car by pivoted hanger rods that it may be swung entirely out of the way beneath the care when not required for use.

Another of the advantages claimed for this fender is that it can be released instantly from its operating position and swung back under the platform of the car when **a collision** with a vehicle or other body is imminent. This is accomplished by the motorman simply putting his foot on a plunger in the floor. The position of the fender is in fact governed by the judgment of the motorman as a foot lever and chain enables him to set the fender in the operating or the carrying position at will.

The position of the scoop however, is governed by the trigger spring which holds it in the normal operating position. After it has been tripped it is necessary to reverse the scoop and set the trigger by hand. The fender is an all steel construction with the exception of the scoop and is claimed to be strong and durable.

Terminal Facilities for M. & S. C.

A deputation from the South Shore of the St. Lawrence have asked a special civic committee to grant the Montreal and Southern Counties Railway appropriate terminal facilities in Montreal, commensurate with the importance of the line; the committee adjourned the matter for further investigation. The present terminus in McGill street is very inconvenient. The route originally proposed by the Company was along Grey Nun street to William street, along the latter, across McGill street, and along the south side of Youville square to St. Peter street. This proposed line was rejected by the committee at a previous meeting, in view of the protests of merchants that the traffic was such that a line of cars was impracticable.

The new electric line running through the Saanich peninsula is nearing completion and it is expected cars will be in operation on or about April 1st, 1913.

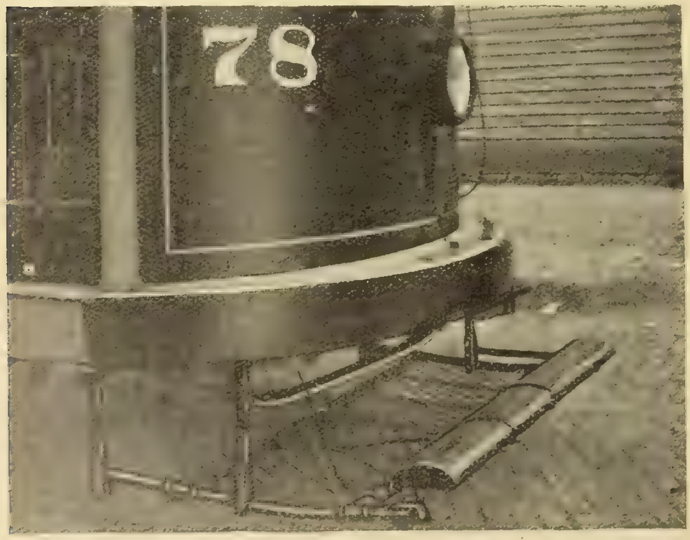


Fig. 3

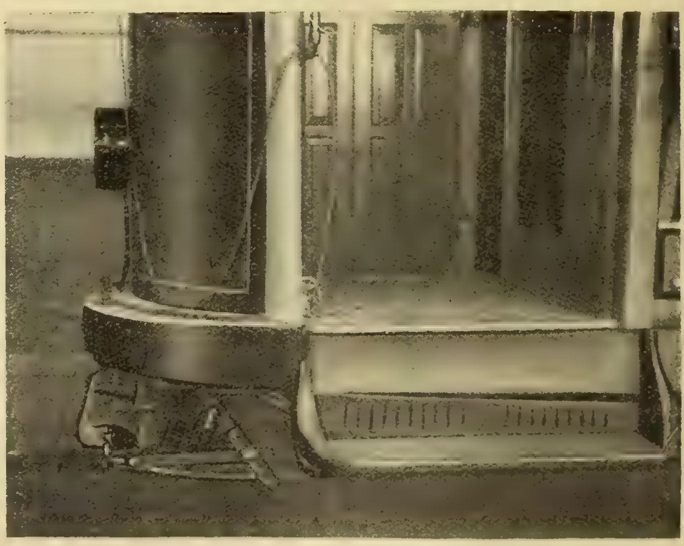


Fig. 4

Illumination

Sign Lighting with Tungsten Lamps

By Mr. O. P. Anderson*

There are to-day approximately 80,000 electric signs in this country. Assuming an average of 100 lamps per sign, this makes a total of approximately 8,000,000 sign lamps in actual service. From these figures the importance of this business in dollars and cents can readily be calculated. Although it may be seen that the revenue from electric signs is already extensive, these figures represent only a small percentage of possible business. In fact, the surface has as yet only been scratched. Before the advent of the drawn wire tungsten sign lamp a number of central stations believed they had reached the "saturation point" with electric signs. The saturation point may have been approached with carbon lamps in a few cases, but this condition has now been changed. The tungsten lamp has opened almost unlimited fields for the use of electric lamps for advertising purposes.

Merchants to-day know the value of electric sign advertising, as is evidenced by the large number of signs which border our principal thoroughfares. Owing to the extreme flexibility of design made possible by the use of incandescent lamps, the sign can be made as plain or fancy as desired. The dealers are satisfied that this is the most efficient method of advertising; that it will attract and compel attention when all other methods fail; that, in fact, it is the most profitable investment they can make. Their only objection has been the cost of operating the old carbon lamps.

Every merchant is in a position to spend a certain percentage of his gross receipts for advertising, including electric signs; but the cost of operating a representative sign with carbon lamps has, in many cases, exceeded that sum, and hence the merchant was compelled to forego the sign. The carbon lamp, however, is now obsolete, it being neither efficient nor attractive. Its place has been taken by the efficient tungsten sign lamp, which removes every objection that any merchant might have had against the old carbon lamp.

The following table gives the total operating cost in dollars per thousand hours with various types of sign lamps, current calculated at 10c per kw. hour.

Table 1

7.5 c.p. 30 watt carbon	$3.10
4.8 c.p. 20 watt carbon	2.10
6.7 c.p. 10 watt mazda	1.20
2 c.p. 10 watt carbon	1.07
3.3 c.p. 5 watt 50-65 v. mazda	.65
3.8 c.p. 5 watt 10-15 v. mazda	.62
1.8 c.p. 2.5 watt, 10-13 v. mazda	.37

In these figures the renewal cost is assumed to be the present standard package price. It will be seen that there is no longer any excuse for the continued use of carbon sign lamps.

Theoretically the operating cost decreases, due to the use of high efficiency tungsten lamps, there is a material increase in the number of consumers. In addition to this the reduction in operating cost makes it possible for existing consumers to burn their signs longer for the same expense, thus getting more advertising, and at the same time greatly improving the load factor of the central station. The gross income to a central station varies with the product of the operating cost per hour, the number of consumers and the number of hours burning. The increase in the number of hours burning and number of consumers will more than offset a decrease in operating cost, the result being a material increase in income to the central station. Therefore, by reducing the operating cost a small amount, it is possible to considerably increase the net profits to the central station, and at the same time give the customer more and better advertising for the same amount of money.

There are a large number of carbon signs throughout the country which are not operated at all, or, at best, only a very short time each night. Clearly this is not profitable business for the central station, nor does it give the merchant results in proportion to his investment. Therefore everything seems to indicate that it is both to the advantage of the central station and merchant that tungsten lamps be used.

Table 2

	10 to 13 v.	50 to 65 v.	100 to 130 v.
Rated and average watts.	2.5	5	10
Watts per candle	1.33	15	1.5
Lumens per watt	7.46	6.62	6.62
Mean horizontal c.p. ...	1.8	3.3	6.7
Mean spherical c.p.	1.4	2.6	5.3
Average total life, hours ..	2000	2000	2000

Table 2 gives the qualifications of tungsten sign lamps in use at the present time. It is now possible to use these lamps on any standard lighting circuit, whether alternating or direct current. The filaments in all tungsten low voltage sign lamps are now made of wire of exactly the same diameter. This means that when these lamps are connected in series and necessarily take the same current they will operate at the same current density and efficiency in watts per candle. This makes it possible to get nearly as good results from series as from multiple operation. Since the diameter of the wire is the same through the entire voltage range, namely, 10 to 13 volts, it is evident that there will be a slight variation in the watts consumed, due to variation in voltage. This is to be desired, however, since the normal amperes are constant. It is therefore possible to operate with entire success a 10 volt lamp in series with 9 and 11 volt lamps. However, this is not recommended as it will be responsible for either an increase or decrease in the efficiency at which all the lamps are operated. In order that there may be no misunderstanding regarding which is, and which is not, the correct way to operate these lamps, each type of lamp will be described separately and recommendations made accordingly.

10 to 13 Volt Lamps

Since these lamps are made for 10 to 13 volts they necessarily have a comparatively short and thick filament which makes them very rugged and able to withstand severe service.

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* Edison Lamp Works, Harrison, N. J.

In cities supplied with alternating current it is always recommended that these lamps be used in connection with a transformer. The expense of the transformer is justified since by its use the best possible performance is secured through multiple operation. It is poor economy, therefore, to wire even small signs in series under these conditions. It is a very simple matter to change over old carbon signs to accommodate these lamps, as it is only necessary to insert a transformer between the service wires and the sign. Care, however, should be taken to see that the size of wire in the sign is heavy enough to carry, without excessive voltage drop, the increased current consumed by the low voltage lamps.

In the past these 10 to 13-volt sign lamps have been a perplexing problem to central stations supplying only direct current. Although many have wired these lamps ten in series with good results, others have had only indifferent success. The difficulty has been largely due to a system of wiring which would permit ten lamps to go out whenever one failed. Since, therefore, the success of series systems of wiring with 10 to 13-volt lamps has been questionable, it is no longer recommended for new sign lamps, especially in view of the fact that the 100 to 130-volt and 50 to 60-volt sign lamps make it possible to employ a better system of wiring. However, should a sign be already wired in series, very good results may be obtained by using carefully selected series sign lamps, the present method of selection allowing every one of the lamps in each series to burn at exactly the same efficiency when consuming the same current. Under no conditions should lamps of different manufacture be operated in the same series.

Although the straight series method of wiring may now be considered obsolete, the multiple series method may still be used with satisfactory results under certain conditions. These conditions are that the sign which is so wired should contain not less than 100 lamps and also that the burnouts be promptly replaced.

50 to 65 Volt Lamps, Two in Series

These lamps will be of great assistance in the sign lighting field, especially for direct current districts. The method of wiring this lamp will be the same on alternating current and direct current circuits. The lamps may be either wired two in series or in multiple-series. In a double face sign it is suggested that each side be wired in multiple, and the two sides placed in series, thus making the condition of operation practically similar to straight multiple. If it is desired to wire two lamps in series it is recommended that the lamps be staggered so that the failure of one lamp will not cause two adjacent lamps to go out. With a double face sign, by wiring one lamp on one side in series with a lamp on the other side, the failure of one lamp will only cause one lamp on each side to go out, and it can readily be seen that with a reasonable amount of care such a sign can always be kept in good condition.

The old signs containing 100 to 130 volt carbon lamps can, in the majority of cases, be re-wired very simply, so as to accommodate these lamps. If it is a double face sign the change can be made by simply connecting one side of the sign in series with the other side at the cutout box. If it is a single face sign, or a double face sign with an equal number of balance circuits, the change can be made by connecting in series two circuits which contain an equal number of lamps. Such changes have been made in a number of cases with satisfaction.

100 to 130 Volt, 10-Watt Lamps

The introduction of these lamps has made possible the simplest and most satisfactory method of operating sign lamps, viz., in straight multiple on standard lighting circuits. Their use means the elimination of a transformer, which will mean a considerable saving in the initial cost. The writer knows of one sign containing about 400 of these lamps which have burned in excess of 2,000 hours, giving an average life of 1,800 hours, with 60 per cent. of the original lamps still in service. The results given in other places, under different conditions, have shown up equally well.

These lamps should prove a blessing to central stations supplying direct current, who have heretofore objected to the series system of wiring, They make it possible to change over all old carbon signs to this lamp without any re-wiring and also to so equip all new signs. In fact there is no logical reason why any new sign should not be supplied with tungsten lamps.

Wiring

The wiring of tungsten sign lamps is very important, especially that of the 10 to 13-volt lamps. It is very essential that the size of the wire be calculated very carefully in order that the Fire Underwriters' rules be not violated, and also in order that the voltage drop be not excessive. According to the Fire Underwriters' rules: "Where wire not inferior in size and insulation to approved No. 14 B. & S. gauge is used, connected direct to standard sockets or receptacles, 1320 watts may be dependent upon final cutout."

Table 3—Capacity in amperes of various sizes of copper wire, and number of 5 and 10-watt lamps that may be operated in multiple thereon.

B. & S. Gauge	Rubber Insulation Amperes	No. 5-Watt 10-13 Volts	No. 5-Watt 50-65 Volts	No. 10-Watt 100-130 Volts
14	12	27	137	137
12	17	38	195	*
10	24	55	275	
8	33	76	*	
6	46	106		
5	54	124		
4	65	149		
3	76	175		
2	90	207		
1	107	246		
0	127	*		

* Exceeds the 1320 watts as allowed by National Board of Fire Underwiters

Table 3 shows the carrying capacity of wires as approved by the National Board of Fire Underwriters, and also the number of tungsten sign lamps, used in multiple, that they may safely carry. It can be seen from this table that the carrying capacity of the wries is the governing feature with low voltage lamps.

With 10 to 13 volt lamps it is very essential that the voltage drop in all cases be less than one-half volt. This is evident, since if a large drop be allowed the percentage drop would be so high that the appearance of the sign would be affected. For instance, a drop of one volt means a drop of 10 per cent., which is entirely too much for satisfactory service.

Table 4 gives the number of lamps that can be operated on each four different sizes of wire with a voltage drop not exceeding one-half volt. Table 5 gives the maximum number of 5 watt, 10 to 13 volt lamps, wired in multiple, that can be supplied from feeders having the size and length in the table, with a drop not exceeding 0.2 volts.

With the 100 to 130 volt 10-watt, and the 50 to 65 volt 5-watt lamps, the ampere rating is very small, and hence the governing feature of the wiring will be the 1320 watts which is imposed by the National Board of Fire Underwriters. With 10 to 13-volt lamps wired in multiple, it is, however, necessary to calculate very carefully the size of wire to be used in each particular sign. Knowing the current to be carried, it is a fairly simple matter to determine

Table 4—Number of 5 watt, 10 to 13-volt lamps that may be operated on each of four sizes of copper wire with a voltage drop not exceeding one-half volt.

Spacing of Lamps in Inches	Size of Wire (B. and S.)			
	14	12	10	8
3	48*	68*	96*	132*
6	48*	68*	88	112
8	47	60	75	97
10	42	54	68	86
12	38	49	62	79
16	33	42	54	68
20	29	38	48	61

Table 5—Number of 5 watt, 10 to 13-volt lamps wired in multiple that can be supplied from feeders of the various sizes and lengths given, with a drop not exceeding 0.2 v.

Combined Length of Pair of Feeders	Size ef Feeder (B. and S.)				
	10	8	6	4	2
3	64*	92*	130*	184*	262*
4	50	77	125	184*	262*
5	40	62	100	158	254
6	33	53	84	135	210
8	25	40	63	101	160
10	20	31	50	79	127
15	13	21	33	53	85
20	10	15	25	39	63
30	7	10	17	26	42

* These limits cannot be passed without exceeding the safe carrying capacity of the wires.

the size of wire to use by referring to the given wiring tables.

There are several methods of connecting the feeders to the circuits when lamps are wired in multiple that will greatly affect the performance of the lamps. This subject has not been given the attention it deserves, and as a result a number of signs are not operating under the best possible conditions.

Sign lighting is now on a very firm and stable basis. City authorities are very favorably inclined toward it, as it is responsible for lighter and brighter streets, without any additional expense to the tax payers. The merchants are pleased, since they are getting more and better advertising without additional expense. A wonderful advance has been made in the art of manufacturing signs, and as a result sign companies are now erecting better and more artistic signs than ever before. In fact, the present conditions are very favorable for a big increase in the sign lighting industry.

"Good Lighting" Campaign

The Ottawa Electric Company have recently been carrying on a "Good Lighting" campaign which is reported to have met with very satisfactory results from the view point of both consumer and company. The idea originated at a lecture given by Mr. C. A. Howe of the Holophane Company to the merchants of Ottawa some weeks ago. One of the immediate results of this lecture was a number of enquiries received by the company from leading business men regarding the better illumination of their places of business. The outlook being so promising, it was decided to enlist the service of the Holophane Company who, on enquiry, were found to be only too pleased to assist, even going so far as to send their chief engineer Mr. F. F. Groome into the field. Pending Mr. Groome's arrival, however, the company prepared the ground by a little judicious advertising and canvassing. When everything was ready, Mr. Groome arrived upon the scene and got right down to work. A small room in the company's show rooms was fitted up for demonstration purposes and handed over for his exclusive use.

The procedure briefly was as follows: Mr. W. H. McIntyre, superintendent of the New Business Department of the Ottawa Electric Company would take Mr. Groome around and introduce him to the customer. The merchants' wishes being ascertained, measurements, etc., would be taken and recommendations made. This sounds very easy but it is impossible to describe the hours of argument and explanation, the demonstrations and interviews and the time spent in estimatings and figurings of the most exacting nature. That Mr. Groome proved himself equal to the occasion is evidence not only of his expert knowledge and patient good nature but also of the worthy cause in which he was working.

Once the installation was decided upon the work was done as rapidly as possible consistent with efficiency. This part of the campaign was shared with the local electrical contractors, as the Ottawa Electric Company does not keep any regular staff of wiremen.

As illustrating the field covered in the short space of three weeks while this campaign was on, the following are mentioned as a few of the businesses treated with good lighting medicine:—wholesale and retail dry goods houses; department stores; tent, awning and lumbermen's supply houses; butcher shops; shoe stores; clothing store (largest in town); the Ottawa public library; the factories of J. W. Woods, Limited; a fine 11-storey new office building and some new business with the Department of Public Works and the new plant of the Beaver Board Company. In addition many enquiries which could not be attended to at the time, were received, but these are being kept ready for a resumption of this campaign at an early date.

It is said that the amount of business taken during this campaign was very considerable. In addition to this there are the two other valuable considerations,—the greater satisfaction among the customers and a distinct advance in the standard of scientific illumination in the city of Ottawa.

Shurlok Prevents Theft

Many buildings suffer by theft of lamps. Strangers strolling through the halls sometimes take the opportunity of removing lamps from the socket, especially since the tungsten type has been in use. To prevent the possibility of removal of lamps, Pass & Seymour have devised their Shurlok type of socket. It is claimed that with this appliance, illustrated herewith, it is not possible to remove lamps. Aside from the question of theft this appliance will prove valuable in hotels, apartment houses, etc., where it is the custom of the people occupying these rooms to remove the lamp and attach such things as warming pads, curling tongs, flat irons, etc. By the use of such apparatus the electric bills of the owner are enormously and often unnecessarily increased. It is impossible to unlock the Shurlok

with anything but the master key and there are no other keys made like them. This key is not given away but is sold at a regular price, only to responsible persons, a further insurance that the people who would carry off lamps are not likely to have a key.

A Portable Eye-Comfort Lamp

The accompanying illustrations represent a new type of portable lamp just placed on the market by the National X-Ray Reflector Company. This lamp is constructed according to the Eye-Comfort lighting system which has become popular in large public installations but is now applicable in the private home or in any room in the home by use of this portable lamp. The lamp is made in either the floor or table type, the latter being shown in one of the accompanying sketches. The light sources are completely concealed but the arrangement of the lamp is shown in Fig. 2, which explains the mechanism. By pulling the switch E the three lamps marked D on the edge of a disc are lighted. These are not usually larger than 100 watt mazda and serve only to give the shade and the illuminated decorative effect of the usual art lamp to light the space immediately below the lamp. A general illumination of the room is obtained, however, by pulling switch F. which lights a large mazda lamp G contained within an opaque X-Ray reflector A. This reflector is held in the correct position with relation to the lamp to secure proper illuminating results, by the holder B. The bottom of the X-Ray reflector is open slightly so that a small per cent. of the light from the large lamp strikes the white upper surface of the disc C and is reflected against and illuminates the shade. This makes the use of the small lamps unnecessary when the indirect light is turned on.

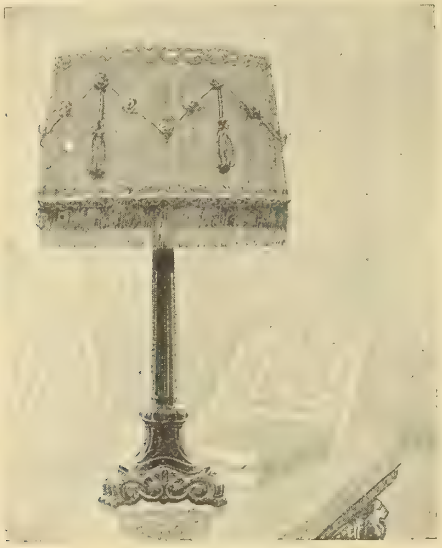


Fig. 1.

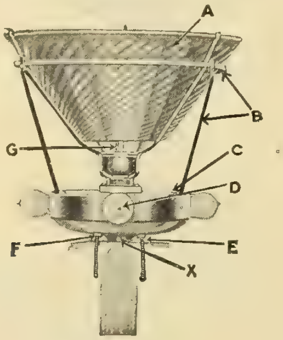


Fig. 2.

Lecture on Illumination

A meeting of the Hamilton Electric Light & Power Company section of the N.E.L.A. was held in the Terminal Building, Hamilton, on Wednesday evening, March 5th, this being the first meeting held since the fine new quarters provided by Manager Coleman for the use of the section have been completed. The room is a good large one on the third floor of the Terminal Building, being 40 ft. x 50 ft., well lighted, heated and ventilated, and artistically decorated. Mr. C. A. Howe, manager of the Holophane Company, Toronto, delivered an address on "Illumination," illustrated by a number of practical demonstrations. There was a large attendance and a great deal of interest was evinced by those present. Addresses were made by Manager Coleman and L. W. Pratt, president of the section. Musical numbers were furnished by Messrs. Kingan, Taylor and Warden.

Truro, N.S. Without Light

Following a series of unfruitful negotiations between the town council and the Chambers Electric Light and Power Company, Limited, on the question of street lighting rates, it is reported power was finally cut off on March 1st, leaving the town in darkness. The rates submitted by the company were as follows: First 100-25 candle power lamps, $22 each per year; second 100-25 candlepower lamps, $18 each per year; third 100 $10; over 300, $5. If 32 candle power lamps were used, an additional charge of $1.50 per lamp was to be paid. If 40 candle power lamps were used, an additional charge of $3 per lamp would be made. Discount 10 per cent. As this rate was not considered satisfactory by the council the company carried out their threat of cutting off supply.

Utilities Exhibit in Vancouver

During February a pure food show was held in Vancouver, B.C., the exhibition being open afternoons and evenings for two weeks. The B. C. Electric Railway Company, Limited, took advantage of the opportunity to exploit its line of electrical appliances, and its booth attracted considerable attention. The exhibits of the company included electric ranges, toasters, percolators and other appliances, all of which were demonstrated by the clerks. On the closing Saturday of the exhibition a popcorn party was held, at which corn was popped on electric grills and distributed to the children in bags which advertised the electrical appliances. The exhibit was considered by the company to have attained good results with reference to the extension of the use of electrical appliances.

The Dealer and Contractor

The Contractor as a Business Man

In the March 15th number of the Electrical News, an interesting article written by a successful contractor on the subject of "The Large Percentage of Failures of Electrical Contractors," has been read with much interest. The weakness of the electrical contractor seems to be, not that he does poor work, but that he takes too little care to see that he makes a reasonable profit. Some of the reasons were outlined in the above mentioned article and one simple remedy at least suggested.

It is perhaps of interest to learn that the electrical contractor in the United States is in much the same position as the Canadian contractor, though this knowledge will probably not carry a great deal of satisfaction. That this is the case, however, is shown by an article recently printed in the National Electrical Contractor, which we reproduce herewith in part, as the conditions there are much the same as in Canada. The article is by Mr. W. S. Hanbridge.

"The average man doing electrical contracting business makes the common mistake of thinking he knows when he really does not know. He starts in with a few thousand dollars, plenty of ambition and a good supply of experience from a mechanical standpoint, but none from the business point. The first mistake he makes is when he falls the victim of the salesmen from the manufacturers and jobbers. Their credit man has told them that the contractor's credit is good for so much. Each salesman does his best, and quite right, to get into the good graces of the contractor and turn as much of his ready cash into stock as possible. This, I believe, is mistake number one. There would be a great deal more sense if the credit man would go to the contractor and explain to him the necessity of keeping his assets in ready cash up to the time he has given the matter careful study and got firmly fixed in his mind that the meaning of the word credit is something that must be handled far more carefully than even one's cash, because a man is not expected to have cash at all times, but if he had been careful with his credit it is just as good as cash.

The second mistake is made when the contractor conservatively estimates a job and then concludes that he must meet some one else's figure in order to establish himself and in a very short time he will get into the way of paying more attention to the figures his competitors put in than to his own, and the result is the jobs do not pan out as well as they should and he is not able to meet his obligations as they become due.

Lack of System

Third, and probably one of the most important, is lack of system. Now when I speak of system I do not mean any expensive top-heavy proposition, but I mean a good simple set of books, properly kept up so that at all times a man knows just exactly where he stands. Opinions vary on how much system is necessary for a business. Personally, I believe that if three-fourths of our cut and dried systems were cut out and a little more good common sense used there would be no need of the average small contractor shying at a bookkeeping system for his business. A good careful girl can be employed for $50 or $60 per month and can keep the books for any firm doing a business under $100,000 a year and it will not take all her time, either.

Great care must be taken in the matter of getting out material, seeing that it is properly charged to the right job and that returns are properly credited. This, of course, must be handled by the store-room end, and if properly kept up and placed in the hands of the bookkeeper it is easy to make a permanent record to the proper jobs. The labor should be carefully charged daily or weekly. This will give the contractor a perfect chart of the condition of his jobs at all times. All incidentals, such as cartage, car fare, etc., that can be charged to jobs should be included.

The next item is to know at all times what your overhead costs you by charging every item, including your own salary, rent, insurance, light, phones, etc. It is a simple matter at the end of the month to add this to your bare cost, thereby showing the entire cost of your job. This, compared with the amount billed, shows monthly whether you have been getting enough money for the business you have done. At the end of the year such things as depreciation, interest, wear and tear, loss of bad accounts, up-keep of guarantee, etc., should be added to your cost so that you will not fool yourself by having any leaks.

Have a Simple System

The above can be elaborated as much as one feels he can afford, but if the average contractor would keep the above simple common sense system, study it, know it and be prepared at all times to present it to any jobber or manufacturer it would be very easy for them to show him what his credit should be. In other words, it is seldom that a credit man is fairly acquainted with a contractor's system until such a time as he is called in to save what he can from the wreck, and I would say to the credit man that you would lose less if you studied and assisted your contractor's system, and I would say to the contractor, make your credit man your Father Confessor; don't be afraid to go to them for advice on any financial transaction, and most important of all, take the advice and use it, for remember, while you have been studying the best way to pull in wires, he has been studying credits.

Fourth. The average contractor is too careless of "Quality and Service." Make these two words your motto, keep them before you at all times. Don't let any small personal gain lead you aside from the path, because the man with "Quality and Service" as his motto, demonstrating same at every opportunity, is building up a bulk-head which will satisfy the most careful credit man.

Fifth. Get your bills out as soon as the work is completed, and use the same precaution that your credit man uses with you, get in your money as quickly as possible. Every bill you send out should be carefully followed up and the money obtained. In fact every bill should have a day of reckoning. If a customer does not pay up on a set day there should be a decided understanding when same should be paid and there should be nothing on your part left undone to further the collection, because outstanding bills never improve. It is your money being backed by your credit and eating up your interest. A prompt collector may sometimes be criticised, but never by the people who are trusting him.

Last and most important of all, meet obligations on the day they are due, and if by accident you are not able, a personal visit to your jobber or manufacturer telling him exactly why you cannot meet it will give him confidence in you. A very common fault with electrical contractors, and probably others, is in reference to this last subject. A contractor does not hesitate to go to a customer seeking a contract. The customer expects the contractor to give him what he is paying for to the letter, therefore, the contractor should not hesitate in having a firm understanding that when his work is done he should get his money, and that said money should be paid at a certain time, and if the customer desires to take a longer time the contractor should impress upon him that it is an accommodation and not part of his regular business. Too many contractors instead of trying to make their customer feel that they are under obligations to the contractor by allowing them time, allow the shoe to be put on the other foot and always feel that they are under obligations to the customer no matter how slow he is."

Operating Air Break High Tension Switches Under Severe Winter Conditions

The rapid development of high tension weatherproof protective and control equipment and the requirements of local conditions have resulted in several distinct types now being tested under actual operating conditions. One of the most difficult tests to secure with high tension air break switches is the effect of sleet or ice. Severe sleet storms are rather infrequent and when they do occur it is often difficult for the switch manufacturer to get on the scene in time to secure essential data. The obvious thing to do, therefore, is to duplicate as nearly as possible the effects of a severe sleet storm as affecting the switch operation, and the accompanying illustration shows a switch used in the test described below.

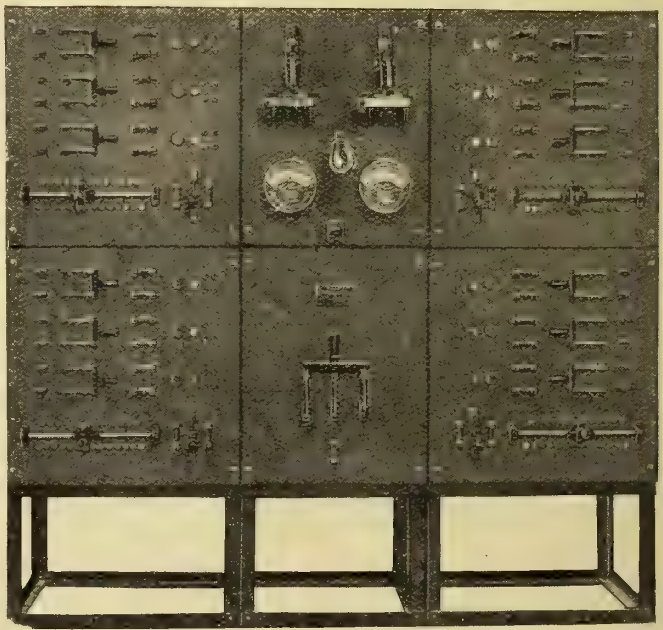
Voltage tests under operating conditions.

The switch is of the 3-pole, PM type, manufactured by the Delta-Star Electric Company, Chicago, Ill., and is mounted on a temporary 4-pole structure, although in actual service installations but 2 poles are necessary. With a temperature of 25 degrees F., and wind velocity of 25 miles per hour as recorded by the Weather Bureau, a heavy spray of water was directed on the switch for approximately 2½ hours. The ice deposit secured was very heavy and resulted in many long icicles extending from the insulator petticoats to the channel iron switch mounting. The operating mechanism connecting the three rotating switch arms is located within the central channel iron mounting base and therefore was not affected by the ice formation—only the exposed elements being coated as shown.

Under the conditions illustrated the flash-over occurred at potentials of approximately 51,000 to 57,000 volts. This value was somewhat variable due to the fact that as the voltage was raised and leakage began, the icicles would begin to melt and stream. During the test a spray of water was kept playing on the switch, thus keeping the ice wet. The combination of ice formation, streaming icicles and steady water drizzle was probably equal to the worst winter conditions, and the result secured will form a basis for the company's developments in high tension switches during the coming year. It is said that additional tests on this type of switch will be conducted in the near future and the results obtained and used in further developments now under way.

Baggage Truck Charging Panels

Economy of current consumption is as desirable in the case of charging batteries as in other lines. With this end in view the battery charging equipment illustrated below and installed in the north station, Boston, of the American Express Company, was designed. This equipment, built by the Cutler-Hammer Manufacturing Company, Wilwaukee, allows for charging 12-cell baggage trucks one at a time, or any number up to 12 trucks at one time. This arrangement, which allows the grouping of trucks on charge, makes unnecessary much wasteful dissipation of current while at the same time keeping the number of separate rheostats to a minimum. There are four charging rheostat panels, two each side of the center panel, and each of these is arranged for charging one truck alone, or two or three in series. The rheostats are of the slider type with resistance grids mounted in frames back of the panels. The double throw switches, above the rheostat contacts, when thrown to the right, connect the batteries of the two or three trucks in series, and when thrown to the left cut into the circuit a fixed block of resistance sufficient to absorb the voltage of the battery at maximum current. The center panel carries single pole cir-

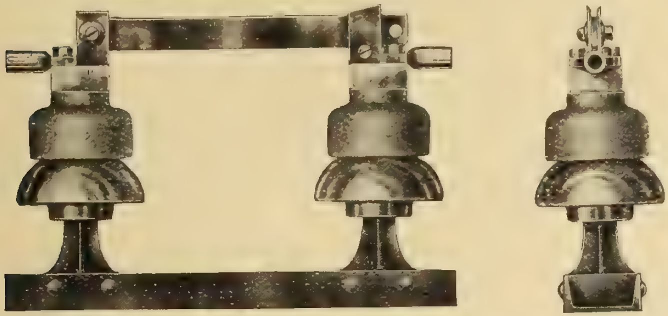


A new battery charging equipment.

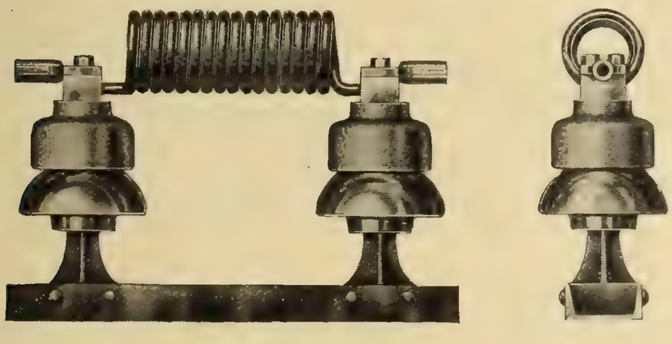
cuit breakers for each of the outside wires of the 3-wire system, on which this equipment is installed, and the meters. In this particular case plug receptacles were placed on the panels with tell-tale lamps opposite each receptacle which indicate when the battery is plugged in.

Choke Coils and Disconnecting Switches

The choke coils and disconnecting switches illustrated herewith are typical of a new line of such apparatus recently brought out by the Electric Service Supplies Company. Several unique points in the design of this apparatus may be commented on. The bases of both the choke coils and disconnecting switches are of standard 3 in. channel iron. These bases permit the apparatus to be installed either inside or out, to be attached to switchboards direct, to cross arms, to poles, to pipe or to any other suitable supporting means. Iron pipes are riveted to this channel and insulators, cemented to these pins, support galvanized iron tops, cemented to them, which tops in turn support brass terminal blocks for either the choke coil or the switch mechanism. Choke coils are sweated into these blocks and in every case are provided with separable terminals. The coils are air insulated between turns. This is advantageous, because if arcing should occur between turns, the insulation (air) is immediately re-established after the passage of the discharge. The manufacturers claim that these choke coils are very rugged in construction, possess great electrical and mechanical strength, and that their design has been worked out so that they afford great protection to electrical apparatus when used in conjunction with their standard types of Garton-Daniels lightning arresters. These choke coils are made for voltage ratings up to 23,000 and for all standard ampere capacities.



200 amp. 13,200 v. disconnecting switch.



200 amp. 13,200 v. choke coil.

In the disconnecting switch, the clips are sweated into the brass terminal blocks, and are made of machine finished, pure, hard-drawn copper. The blades are hung in the clips as shown, and tension screws are provided at each end to secure proper contact. Separable terminals are provided on these switches for all capacities. These disconnecting switches are designed and intended for use not only as lightning arrester disconnecting switches to disconnect arresters from the line for purposes of inspection, repair, etc., but also as switches for disconnecting and controlling high voltage lines, branch feeders, emergency feeders, etc., and for numerous other purposes for which such switches are required. They are made for voltage ratings up to 23,000 and of suitable ampere capacities to meet any operating conditions.

X-Cell with Spring Connections

We illustrate herewith the lastest improvement on X-Cell connections. This well known type of spring connection is soldered to the carbon brass cap of the cell so that loose connections are impossible. By the use of this connection there are no screws to tighten, no plyers are needed, no more sore fingers have to be endured—just press the clip and slip in the wire. This connection has been adopted exclusively by the Bell Telephone Company of Canada, by over 400 other telephone companies and by leading firms in the automobile and general electrical trade. The Canadian patent for this binding post is held by the Canadian Carbon Company, Limited. The advice given by this company is that you install X-Cells with their new spring connectors in your telephone, automobile, engine, motor boat or any where and forget them for "nine lives."

Northern Electric Notes

Great enthusiasm prevailed at the annual hockey games held in the old Victoria Rink to decide who should possess the telephone trophy for the coming year. The Bell Telephone Company's team were the winners last year, but the N. E. boys decided that it should be their turn to bring the cup home. There were two games in the series, the N. E. team winning both; first by a score of three to nothing and the second by a score of three to two. The final game was very close; the Telephone team scored the first two goals in rapid succession, while in the second 20 minutes the N. E. evened matters up. Only one goal was needed in the last half and Hughes was responsible for this.

Messrs. Doherty & Allen are now in the West representing the General Department at the Distributing House Sales Conference, the first of which was held by Montreal during the week of February 7th.

Mr. Ward Still on the Job

In our March 15th number, by a slip of the pen, we were made to say in our personal section that Mr. A. J. Soper had been appointed district sales manager for Ontario for the Northern Electric & Manufacturing Company. This of course, should have been the Imperial Wire & Cable Company as reported in the article under that heading on another page in the same issue. Mr. J. F. Ward is, as everybody knows, in charge of the Toronto office of the Northern Electric & Manufacturing Company.

Change of Address

Macbeth-Evans Glass Company of Pittsburgh, Pa., the makers of the well-known "Alba" glass for high efficiency illumination, owing to increased business and the call for more extensive show-rooms and demonstrating facilities are moving their Toronto sales office and showroom from 70 King street west to 160 Bay street. This change will take place on or about the 1st of April.

Transmission Engineering Co.

The Transmission Engineering Company has been organized in Pittsburgh to do special transmission line work. It is affiliated with the Railway & Industrial Engineering Company, manufacturers of the Burke horn-gap apparaturs, and is making a specialty of outdoor steel sub-stations, and special work for terminal towers, station outlets, railroad crossings, and similar requirements. The officers are H. L. Patterson, president; G. N. Lemmon, vice-president and general manager; B. W. Kerr, secretary-treasurer, and A. W. Burke, consulting engineer.

Annual Meeting N. E. L. A.

The 36th annual convention of the National Electric Light Association will be held at the new Medinah Temple, Chicago, June 2, 3, 4, 5 and 6, 1913. The house committee has already sent out a schedule showing the hotels available with the rates charged in each.

The Electrical Repair Company

Announcement is made by the Electrical Repair Company of the opening of new premises at 122 Wellington street west, Toronto, where every facility for the repair of every kind of electrical apparatus is now installed.

Small Refrigerating Machine

The H. W. Johns-Manville Company are distributing a folder describing the Audiffren-Singrun refrigerating machine, for which they are agents. This is a machine operated by a small electric motor of which the power ranges from one-half to four horse power, depending on the cooling effect or ice-making capacity of the machine.

Trade Publications

The Curtis Portable—A bulletin issued by the National X-Ray Reflector Company, descriptive of a portable lamp constructed on the indirect principle.

The Keystone Traveller—March, 1913, issued by the Electric Service Supplies Company, Philadelphia, contains much interesting information regarding this company's products. The publication states the policy of the company regarding the selling of their material and the benefits they have derived by using straightforward methods. A good reproduction of a lightning flash is used to introduce their chapter on Garton Daniels arresters. The booklet also contains other useful and interesting information.

Pneumatic Tools—Catalogue 10 issued by the Pittsburg Pneumatic Company of Canton, Ohio, descriptive of this company's air operated hammers, riveters and other devices. The catalogue is being distributed in Canada by R. E. T. Pringle, Canadian agent.

Electric Grinders—Bulletin No. 23 issued by the Van Dorn & Dutton Company of Cleveland, and distributed by their Canadian agent, R. E. T. Pringle. This bulletin deals with a recently developed line of portable electric grinders in various types.

Shurlok—Bulletin issued by Pass & Seymour, containing facts, entertainingly told, for the man who wishes to protect himself against the loss of lamps.

Catalogue—issued by the F. J. Drake & Company, Chicago, describing their publications, which cover practically every phase of electric, gas, cement, etc., work.

New Books

Electrical Machine Design.—The design and specification of direct and alternating current machinery, by Alexander Gray, Whit. Sch., B.Sc. (Edinburgh and McGill), assistant professor electrical engineering McGill University, Montreal. The McGraw-Hill Book Company, New York, publishers; price $4 net. This book was compiled from a course of lectures on electrical machine design delivered at McGill University. The machines discussed are those which have become more or less standard, namely, direct current generators and motors, alternating current generators, synchronous motors, polyphase induction motors and transformers. The principle followed throughout the work is to build up the design for the given rating by the use of a few fundamental formulae and design constants, the meaning and limits of which are discussed thoroughly and the same procedure has been followed for the several pieces of apparatus. It is pointed out in the preface that the design of electrical machinery is as much an art as a science and that no list of formulae or collection of data is sufficient to enable one to become a successful designer. There is a certain amount of data, however, sifted from the mass of material on the subject which every designer finds convenient to compile for ready reference. This work contains data that the author has found it necessary to tabulate during several years of experience as a designer of electrical apparatus. The book is well printed and illustrated.

Experimental Wireless Stations—By Philip E. Edelman, published by the author at 2432 Lyndale Avenue South, Minneapolis, price $2. This book deals with the theory, design, construction and operation of experimental wireless stations and gives a complete account of sharply tuned modern wireless installations for experimental purposes which comply with the new United States wireless law. The book is intended particularly for experimenters and only matter which directly contributes to the practical presentation of the art has been included. The illustrations, of which there are eighty, consist of simple line drawings to illustrate constructional details, these having been deemed much more useful than half tones, which only show the general appearance of any particular type of instrument.

Alternating Current Machinery.—By Jas. R. Barr, A.M.I.E.E., and R. D. Archibald, B.Sc., A.M.I.E.E., etc.; Whittaker & Company, London and New York, publishers; price 12s. 6d. net. The opening chapter is devoted to a mathematical treatment of complex wave forms; a chapter is devoted to insulation; transformers are treated with regard to their underlying principles, losses and efficiencies, and design; alternators are discussed with reference to their mechanical construction, e.m.f. equations, reaction, regulation, impedance, losses, parallel working and design; three chapters are given to rotary converters under which heading is treated the transforming ratio, armature reaction and windings, voltage regulation, losses, heating, efficiencies, and design. 496 pages, illustrated with 332 photographs and 16 plates.

Baudot Printing Telegraph System—by H. W. Pendry; Whittaker & Company, London and New York, publishers: Price 2s. 6d. net. The adoption and development of the Baudot system by the British Post Office has brought about a demand for information concerning this form of machine telegraphy, which is claimed to be one of the most brilliant achievements of modern invention. This little volume is designed to furnish a treatise which is a comprehensive description of the different features of this system. 144 pages, well illustrated.

The total number of arc lamps in the city of Vancouver at the end of 1912 was 1,669, an addition of 248 lamps during the year. The number of ornamental cluster light standards in use at the end of 1912 was 621, of which number 352 were installed during 1912. Ornamental cluster light standards under construction at the present time are,—Harris street, 76; Hastings street, 44; Granville street, 40; Main street, 59; total 219.

Current News and Notes

Battle Hill, Ont.

Mr. Geo. Cook, Glencoe, is said to contemplate building a dam and installing a power plant.

Brockville, Ont.

The Light & Power Department has instructed Mr. Philip, Superintendent, to get particulars re another pump unit in the pumping station. Manager of Department, Mr. Philip. Engineer, J. H. Bryson.

Representatives of the Morrisburg and Ottawa Electric Railway Company have had an interview with the mayor and council with a view to extending their line to this city, making Brockville a terminal with branch lines through the town.

Bear River, N.S.

The Bear River and Digby Electric Light, Heating and Power Company, Limited, have for sale a 30 kw. C.G.E. alternating current generator, 1,100 volts, 1,500 r.p.m. with switchboard, exciter, etc. Also transformers sufficient for 360-16 candle power lamps at 104 volts.

Brantford, Ont.

It is reported that right-of-way for the Lake Erie and Northern Railway Company has been purchased nearly all the way between Paris and Galt and that work will soon be begun.

The Brantford waterworks system have been quoted a price of $24 per h.p. by the local hydro-electric management. The steam pumps will be kept as auxiliaries or for peak load requirements.

Barrie, Ont.

The profits of the electric light plant for the year ending December 31st, 1912, amounted to $5,000. This corresponds to approximately 20 per cent. of the total receipts. The total liabilities of the corporation in connection with this department are placed at $99,706.

Buckingham, P.Q.

It is reported that work on the new power house being installed at the foot of Dufferin Falls is progressing rapidly and that the plant will be in operation in a couple of months.

Dundas, Ont.

It is reported that Martin H. Hewitt, cement block manufacturer, will require motors for operating new machinery.

Dauphin, Man.

Tenders for electrical machinery were received up to March 19th for the electric light plant of the town of Dauphin, Man. The engine will be a vertical, compound condensing force feed lubrication engine, 360 r.p.m. and a 225 kw. 60-cycle, 2-phase 2,200 volt generator. The requirements also include a switchboard and accessories and a belt driven exciter. Thirty-eight 5-light standards will be installed carrying four 60 watt and one 100 watt tungsten lamps each. Two 10 kw. transformers 2,200/105 volts will also be purchased.

Edmonton, Alta.

Tenders were called up to March 22nd for laying approximately twelve miles of railway track.

Ft. William

The Canadian Car & Foundry Company have recently purchased for their new car shops at Fort William, Ont., a 375 h.p. Robb vertical two-crank compound engine for direct connection to a 250 kw. electric generator. This engine, the latest design of Robb vertical compound engines, is to operate at 360 revolutions per minute. It is being built by the International Engineering Works, Limited.

Fredericton, N.B.

A charter has been granted the Suburban Railway Company with powers to build and operate street car lines in the suburbs of the City of St. John.

Fraserville, P.Q.

At the present time the streets are lighted by arc lamps but it is likely the whole system of electric lighting will be renewed within the next year.

Fort Frances, Ont.

A report has been made by the Hydro-electric Power Commission of Ontario on the possibilities of the Sand Island Falls which are said to be capable, under proper storage conditions, of developing 3,000 h.p.

Guelph, Ont.

Application has been made to the Ontario Legislature for authority to pass a by-law to provide for combining the following civic departments, namely: waterworks, gas, electric light, heat, sewage, public works and Guelph Radial Railway under one commission.

Galt, Ont.

This town is now using 1,000 h.p. as compared with 600 h.p. when the system was inaugurated.

The Canada Foundry Company are supplying two centrifugal pumps for the water works department here. These pumps will be driven by one 250 kv.a., 2,200 volt, 3-phase, 25-cycle, 750 r.p.m. Swedish General Electric synchronous motor supplied by Kilmer, Pullen and Burnham. It is expected the installation will be completed about May 1st.

Hamilton, Ont.

An application has been made for an act incorporating the Hamilton Mountain Electric Railway Company.

Harriston, Ont.

After being without street lights for three years current was again turned on March 15th.

Hull, Que.

Extension of railway to Connaught is contemplated. Length—½ mile double track. Weight of rail, 60 lbs.; gauge 4 ft. 8½ in.

Halifax, N.S.

The government has introduced a bill providing for the establishment of a rural telephone system. It is proposed that the government should give a subsidy of $20 per mile, the farmers to furnish and erect the poles, and the government to undertake the stringing of the wires. It is also proposed that the farmers buy their own telephones and pay a small charge for connecting with exchanges in the neighborhood.

A bill has been introduced in the House of Assembly to incorporate the Halifax Tramways and Power Company, Limited. The incorporators are the directors of the Halifax Electric Tramway Company and the objects of the new company are explained to be the development of hydro-electric power and the acquisition of the Halifax Electric Tramway Company. The capital of the new company is placed at $5,000,000. Power would be obtained through the acquisition of the Nova Scotia Power Company which controls the falls on the Gaspereux River.

Kingston, Ont.

The light, heat and power department of the city of Kingston, Ont., are at present installing a 500 kv.a. steam turbo equipment complete with pumps, condensers and new switchboard. This department is also at the present time preparing a report on the local water works condition for which an additional 6,000,000 gallon pump will be required. It has not yet been decided whether steam or electric drive will be installed, but extensions must be made during the present year. Other electrical work in Kingston includes the placing of all wires underground on the main thoroughfare in view of the adoption of permanent pavements. This will also necessitate the installation of new lights for the paved sections. This work is in charge of Mr. C. C. Folger, general manager of the light, heat, power and water departments.

The Board of Trade is again urging the city council to ask the Hydro-electric Power Commission of Ontario to supply them with current from High Falls on the Madawaska River. This matter was considered some time ago, and it was decided that pawer could be produced in Kingston at too low a rate, by steam, to justify the hydro-electric development.

London, Ont.

It has been suggested that in order to relieve the street car congestion from South London a subway be constructed at Ridout street. It is probable however, the improvement would consist of a deep cutting under the Grand Trunk tracks.

The Hydro-electric Power Commission of Ontario who were asked to give a ruling in the dispute between certain members of the council as to the proper cost of street lighting have placed the amount of $29,700 per year. The amount actually charged is $29,000, but it has been maintained by members of the council that this sum was too large by $14,000 or $15,000.

It is said that the London and Lake Erie Transportation Company have made an offer to supply the village with light but the hydro-electric commission does not approve of this plan. It is likely that power will be supplied by the commission.

Lambeth, Ont.

Lambeth Telephone Company, Limited, has been incorporated with a capital of $10,000, to carry on the general business of a telephone company in the Township of Westminster, with head office at Lambeth. The provisional directors are Dr. A. R. Routledge, A. G. Howse, salesman, and Dr. G. A. Routledge, all of Lambeth.

Montreal

At the annual meeting of the Cedars Rapids Manufacturing and Power Company, Montreal, Mr. Howard Murray presiding, the report of the construction work now proceeding was read, it being stated that satisfactory progress is being made. The retiring officers and directors were re-elected.

Shareholders of the Montreal Tramways Company at a special meeting on March 6th authorized the directors to issue $18,000,000 of capital stock in allotments and at prices to be decided on according to the requirements of expanding business and new lines to be constructed. Mr. E. A. Robert, the president, said that no decision had been reached as to when the first issue would be made. He expected that the first issue would be something between three or four million dollars. This would depend on the reports and estimates now being prepared by the engineers and the outcome of any agreement which might be made with the city as to what extensions and improvements should be made. The money would be raised partly by the sale of the unissued common stock and partly by the issue of bonds. The engineers' plans would, it was expected, be ready for consideration at an early meeting of the company.

The Bell Telephone Company propose to lay conduits on about 40 streets in Montreal for the purpose of their own wires, the cost to be borne by the company. The Board of Control of the city have recommended the city to give the necessary authority. The company are to reserve a duct for the police and fire alarm wires, and also to restore all pavements or street surfaces, as well as making a deposit of $12,000 with the city as a guarantee of doing the paving work.

Two of the C. P. R. Telegraph wires between Montreal and Toronto have been equipped with the Morkrum printing telegraph. Each circuit is worked duplex, so that on the two wires two messages can be sent in each direction simultaneously. At the sending end is a keyboard somewhat similar to a typewriter and all that has to be done to transmit a message is for the sending operator to depress the keys in the same manner as though writing a letter or telegram on the typewriter. With the instrument is a recorder which shows exactly what keys have been depressed and whether any mistake has been made. At the receiving end the operator simply feeds in ordinary message blanks as required, and the messages are printed automatically on them. The installation, which was made as an experiment, has turned out satisfactorily.

The Quebec Public Utilities Commission have decided that the Montreal Tramways Company are bound to supply certain information asked for by the Commission. The company denied the authority of the Commission to compel the production of documents relating to the service, condition of roads, etc. Col. Hibbard, the chairman, strongly urged the company and city to get together, so that an adequate service might be provided, and regretted that the Commission had not the jurisdiction to order a remedy, although willing, if required, to act as intermediary. With that hope, the Commission suspended the inquiry into the service of the company.

Mr. Justice Beaudin, Montreal, has given judgment for the defendant in a preliminary stage of the libel action for damages of $650,000 brought by the directors of the Montreal Tramways Company against the "Herald." The latter contended that it was competent to plead that the particular article complained of was to be read in conjunction with other articles on the subject of the tramways management, while the directors held that the defendant would have to stand or fall by the one article. His Lordship dismissed the demurrer, on the ground that it was a case for the judge and jury at the trial to decide.

The March 15th number of the Electrical News was made to say that the Bell Telephone Company would be allowed to erect poles on twenty-three streets in Montreal and that the Montreal Electric Service Commission had submitted plans therewith. We are advised by Prof. Herdt, chairman of this commission that the Electric Service Commission had nothing whatever to do with this matter, did not submit any plans nor make any recommendations regarding service to the telephone customers.

Medicine Hat, Alta.

Complaints are made of the inadequacy of the street lighting in this city, and it is understood that as soon as the street railway question shall have been settled, the lighting system will be fully considered.

Moose Jaw, Sask.

By-laws were recently passed authorizing the expenditure of $75,000 on a fire alarm system and $185,000 for electric light and power extensions.

New Westminster, B.C.

Among the local improvements planned by the B.C.E.R. Company for the year are freight yards capable of accommodating some 500 cars.

The provincial government has decided to light the southern portion of the Fraser Bridge and the approaches thereto. It is said negotiations are proceeding with the Western Canada Power Company for the installation of the lamps and the supply of current.

Ottawa, Ont.

It is said the Ottawa Light, Heat and Power Company contemplate the purchase of electric lighting services and fixtures to cost $250,000.

The Wagner bill introduced recently at Washington and designed to repeal the charter of the Long Sault Development Company passed the senate by a vote of 32-11.

Reported Ottawa Electric Railway will build 1½ miles double track; weight of rail 70 lbs.; gauge 4 ft. 8¾ in.

Orillia, Ont.

It is said that the government's plans with reference to the Trent Valley canal will require the removal of Orillia's present hydro-electric plant to a point some two miles farther down the river.

Port Arthur, Ont.

Tenders received by Commissioner, J. J. Hackney, until March 31st for (a) No. 2/0 round trolley wire, 8 tons; No. 4/0 flexible feeder wire, D.B.W.P., 6¾ tons, (b) rails, spikes, angle bars, bolts, (c) steel intersections, frogs, switches, etc.

Port Moody, B.C.

It is reported plans are now under way for the construction of a tramway line between Port Moody and New Westminster by the B.C.E.R. Company.

Prince Albert, Sask.

It is reported that negotiations have been completed for the purchase of a site for a new telephone exchange. The government will install either the central energy system or an automatic system.

Portage la Prairie

The Bill of the Portage Radial Railway Company passed the Provincial House on February 15th, and is reported to have received such a large measure of financial support as to warrant operations being started immediately. This is an electric road which will operate between Portage la Prairie and Winnipeg, running through St. James, St. Charles and Headingly, and along Pigeon Lake, one of the choicest agricultural districts of the province. To date $25,000 has been subscribed, the amount required by the charter to authorize the company to carry on the business. A large number of subscriptions have been promised from interested farmers along the route and in this way the directors expect that $150,000 will be raised.

Quebec, Que.

Langelier Boulevard will be lighted with new ornamental cluster lights and it is recommended that a number of these lights be placed along the ramparts between the Archbishop's palace and Hamel street and on D'Auteuil street. W. Baillairge is City Engineer.

Rapid City, Man.

The gas electric plant installed by the British Canadian Engineering and Supply Company in this town was placed in operation early in March. The rate to consumers will be 20c per kw. hour with a minimum monthly charge of $1. Mr. T. Towns, formerly of Renfrew, Ont., has been placed in charge of the plant.

Regina, Sask.

Tenders will be received up to April 30th, by the city commissioners of Regina, Sask., for one 1,200 kw. synchronous motor-generator, or motor-converter set, complete with panel for the control of the a.c. motor and generator panel and equalizing pedestal for the control of the d.c. generator.

St. Thomas, Ont.

Plans are to be prepared for putting in crossing with derail and electric connections complete at William street.

St. John, N.B.

The St. John Railway Company opposed the St. John Suburban Railway Company's bill before the legislature recently on the ground that the former had an exclusive franchise to the streets of St. John city and county and that they were willing to make all necessary extensions.

A recent report made by Mr. J. B. McRae, Ottawa, on the value of the Meductic Falls as a source of hydro-electric power was unfavorable. It is stated that a water project, development at this point is not commercially feasible.

St. Stephen, N.B.

Powers of the St. Stephen Electric Railway Company have been extended by the government and they are now able to generate electric power and dispose of it for all commercial purposes.

Swift Current, Sask.

Time is extended to April 14th for receiving tenders for 1-200 kw. and 1-400 kw. a.c. generator direct connected to high speed vertical engines or horizontal turbines.

St. Catharines

The Niagara, St. Catharines & Toronto Railway Company are busy building their extension from St. Catharines to Niagara-on-the-Lake, a distance of twelve miles. Orders have been placed for two 500 kw. C. G. E. rotary converters and transformers for St. Catharines and a 750 kw. Westinghouse rotary and transformers for Niagara-on-the-Lake. The 300 kw. rotary now in the St. Catharines station will be removed to Niagara Falls, Ont., and placed in the sub-station there.

Saskatoon, Sask.

The reports submitted by electrical superintendent Hanson for the month of February show a peak load of 2,320 kilowatts. During the month 581,266 kilowatt hours were generated producing a revenue of $32,011 or 5.5c per kw. hour. This was at a cost of 1,447 tons of coal which works out to 4.5 pounds of coal per kw. hour.

Sunday cars operated for the first time on March 9th and were patronized to the extent of 8,522 passengers, the receipts amounting to $426.10.

Stratford, Ont.

The Stratford Street Railway Company, in making an agreement with the city of Stratford, introduced the condition that they could use power supplied by the Hydro-electric Power Commission or from any other source, as they found it cheapest. This clause was recently approved by a vote of the citizens of Stratford, but the Ontario government has intervened and the clause is cut out of the bill as not being in accordance with the agreement existing between the city of Stratford and the power commission.

Silverton, B.C.

It is stated that a contract has been closed with the New Denver Electric Light Company to run a power line to Silverton and supply light and power.

Toronto, Ont.

The Ontario Railway Board has approved the plans of the Toronto and Suburban Railway Company to run a line from Toronto through the county of Wellington to the city of Guelph.

All the Canadian Pacific Railway telegraph wires running into the central office are being placed underground from the Board of Trade building at Front and Yonge to the Canadian Pacific Railway building at King and Yonge streets.

The Ontario Railway Board have given orders that the Toronto suburban railway must have in operation the lines on Annette street and Pacific avenue not later than December 1st of this year. The line will be single track.

In the March 15th number of the Electrical News, an article on the subject of ozone purified air, by Mr. S. W. Canniff, was made to say that in the subways of London, Eng., 8,000,000 cubic feet of air are ozonized daily. Mr. Canniff wishes to correct this number, which should have read 80,000,000 cubic feet of air per day.

A suggestion has been made that the local improvement plan should be applied to the extension of civic street car lines in Toronto.

The Forest Hill Electric Railway Company were successful in getting their bill through the railway committee. This will mean the granting of a charter to construct and maintain a railway on Forest Hill Road along Eglington avenue and north on Dufferin and Bathurst streets.

Teeswater, Ont.

It is reported a number of new lights, wiring, etc., will be purchased for extensions to be made to the lighting system.

Vernon, B.C.

Tenders will be received up to April 11th, for the supply and installation of a 500 B. h.p. Diesel engine, a 375 kw. 2,300 volt, 3-phase, 60 cycle generator with direct connected exciter and a 10-ton travelling crane.

On March 10th, the following by-laws were passed: $35,000 for reconstructing the electric lighting system, $50,000 to extend the electric light plant and $15,000 to make extensions to the electric lighting plant and to construct a power house.

Victoria, B.C.

It is said that the p.a.y.e. system will soon be installed on a number of lines of the B.C.E.R. Company's system here.

It is said an attempt is being made to remove all the poles on Government street between Humboldt and Cormorant and to support all wires from the walls of the buildings lining this street.

Vancouver, B.C.

The civic authorities of Vancouver recently met chief engineer Conway of the British Columbia Electric Railway Company and discussed the possibility of the company placing its wires through the centre of the city in underground conduits. It is stated that Mr. Conway promised that within a few weeks he would submit plans showing an extensive system of underground conduit work for the city business district. In carrying out this project the city will have, as far as possible, the conduits laid in the lanes.

Following on the agreement of the Western Canada Power Company to supply 40,000 horse-power to the British Columbia Electric Railway Company, new arrangements for financing the company have been approved. A syndicate of New York bankers have organized the Western Canada Public Utilities Company, Limited, and they have agreed to take over $4,000,000 par value of refunding bonds and $2,000,000 par value of the shares of the treasury stock of the Western Canada Power Company, Limited, at prices equal to 90 per cent. of par for the bonds and 80 per cent. of par for the shares.

City Electrician Fletcher has submitted a comparative statement on the cost of electric lighting in ten of the largest western cities to prove that the electric lighting rates in Vancover are too high.

The Canadian Crocker-Wheeler Company, Limited, St. Catharines, Ont., branch office Vancouver, have just recently delivered to the Britannia Mining and Smelting Company, Britannia Beach, B.C., a 150 kw. direct current generator, direct connected to a Pelton water wheel. This generator will supply extra power to the company's mine electric railway, which has been increased in capacity. The extensive plant of the Britannia Mining and Smelting Company is situated on Howe Sound, about 20 miles northwest of Vancouver.

Windsor, Ont.

Tenders have been called for a 200 h.p. generator and 100 ornamental poles to carry five light clusters. An underground distribution system will supply the lighting current.

Wingham, Ont.

Council contemplates the purchase of a new generator and additional electrical equipment.

Westmount, Que.

Money has been voted for purchase of arc lamps to cost approximately $1,500.

Winnipeg, Man.

Contract has been awarded to The Canadian Westinghouse Company for 9,000 kw. transformer capacity.

Contract has been awarded to the Canadian Crocker Wheeler Company, St. Catharines, Ont., for 1-130 h.p. slipring, constant speed, induction motor, 3-phase, 550 volts, 60-cycle, 720 r.p.m., and 1-40 h.p. squirrel cage, constant speed, induction motor, 550 volts, 3-phase, 60-cycle, 1,200 r.p.m. for city quarry at Stony Mountain.

Tenders are called to May 15 for two 3-phase generators, 3,000 kv.a., 60 cycle, 6600 volt, for power house at Point du Bois.

Welland, Ont.

It is reported that the Welland Electric Company, in competition with which a municipal plant is being installed, are reducing their rates considerably.

Yarmouth, N.S.

The Grand Hotel Company will ask tenders re installing an up-to-date electric passenger elevator in their 4-storey hotel.

New Companies

The Mission Fixture Company has been incorporated with head office at Vancouver.

The British American Manufacturing & Power Company has been incorporated with head office at Vancouver.

SIEMENS BROS. DYNAMO WORKS | SIEMENS BROS. & CO.

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SIEMENS

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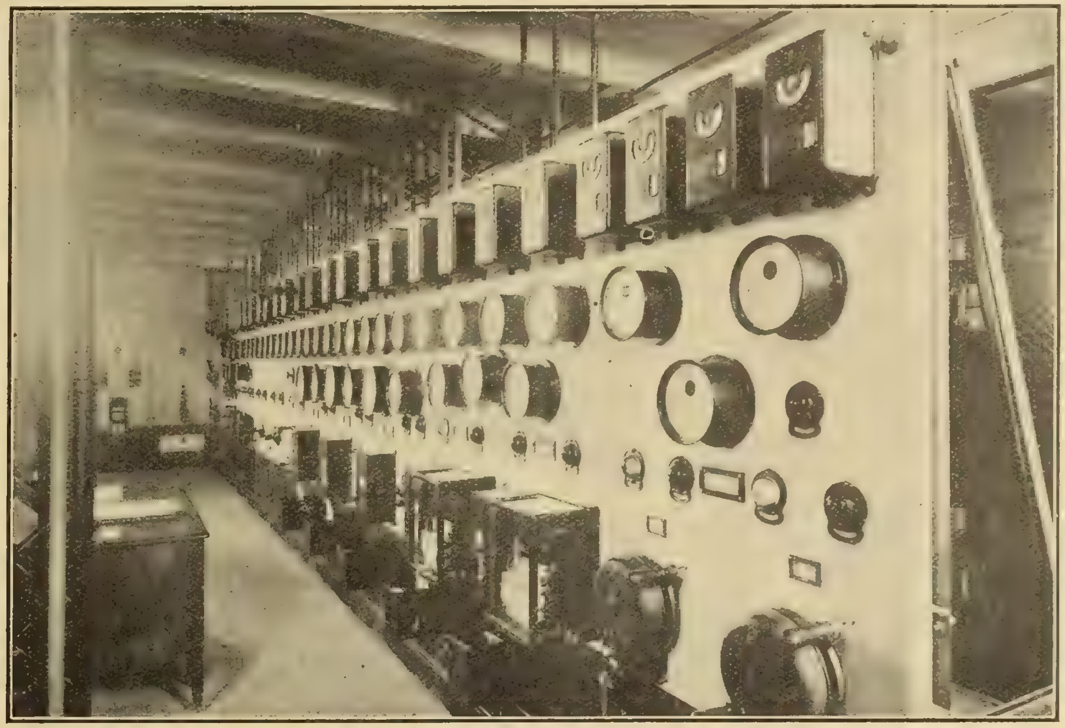


Siemens 18 Panel 22000/2200/600 Volt Switchboard supplied and installed by us for the city of Port Arthur

We supplied the complete sub-station equipment, consisting of 7-750 K.V.A., 22,000 volt transformers, switchboard shown above, lightning arresters and 2-750 H.P. motors generators.

Half the foregoing was a repeat order after our apparatus had been in satisfactory operation for 18 months.

We undertake the complete equipment of electrical plants of every description up to and including 110,000 volts.

Siemens Company of Canada, Limited

HEAD OFFICE:
Transportation Building - MONTREAL

BRANCH OFFICES:

STANDARD BANK BUILDING
TORONTO

McARTHUR BUILDING
WINNIPEG

Condensed Department

RATE

Positions Wanted Positions Vacant Miscellaneous.	2 cents a word per insertion.

Tender advertisements, equipment for sale, etc., 15 cents per agate line (14 agate lines make one inch) per insertion.

Advertisers who wish to conceal their identity may do so by using an Electrical News box number without extra charge.

Car Ventilating Systems

The Vacuum Car Ventilating Company has commenced manufacturing Mechanical Car Ventilating Systems under Canadian Patent No. 128070, dated September 13, 1910, and is prepared to furnish same on demand. For detailed information and prices, address Lock Box No. 25, Windsor, Ont. 10-t.f.

For Sale

The Corporation of Hespeler will have for sale shortly:—

One 12 x 12 Goldie Ideal Engine, 315 r.p.m.

One C.G.E. 2300 volt, 26 ampere, single phase, 60 cycle Generator.

A number of 5 kw. Transformers and also a number of 60 cycle meters.

All of the above plant is now in commission and is being discarded, making way for a 25-cycle installation.

Kindly address any enquiries to the Chairman, Hydro-Electric Power Commission, Corporation of Hespeler, Hespeler, Ont. 6-7

CITY OF VERNON, B. C.

Tenders for 500 B.H.P. Diesel Engine and 375 Kw. Generator

Tenders will be received up to 3 p.m., **April 11th, 1913**, by D. G. Tate, City Clerk, Vernon, B.C., for the following equipment:

Supply and installation of one 500 B.H.P. Diesel Engine.

Supply and installation of one 375 kw. 2300 volt, three phase, sixty cycle, generator with direct connected exciter.

Supply of one ten-ton travelling crane.

Specifications may be seen after March 20th, at the City Hall, Vernon, B.C., the offices of the Electrical News, and Canadian Engineer, Toronto; the Contract Record, Winnipeg; and the Consulting Engineers, Vancouver.

MATHER, YUILL & COMPANY, LTD.,
Consulting Engineers,
12-14 Vancouver, B.C.

FOR SALE

One 50 h.p., 25 cycle, 3-phase, 550 volt C. G. E. induction motor. Complete with pulley base and starting box. Practically new. The Hespeler Furniture Co., Hespeler, Ont. 7-9

Town of Swift Current, Sask.

Tenders for Electrical Machinery

The time for receiving tenders in connection with the above has been extended from Monday, March 31st, till noon of Monday, April 14th.

GEO. D. MACKIE,
12-13 Town Engineer.

CITY OF SASKATOON

Machinery For Sale

One "Robb Armstrong" Horizontal Engine.

One "Canadian Westinghouse" Alternating Current Generator, 2 phase, 60 cycle, 125 kw., 2200 volts.

One Jet Condenser Air Pump.

Two "Canadian Foundry Company" Horizontal Tubular Boilers, each 250 h.p. capacity.

One "Robb Armstrong" Horizontal Engine, arranged for direct connection to a 225 kw. Generator on a 13-inch shaft.

One "Allis-Chalmers-Bullock" Generator—Rating 225 kw., 2200 volts, 2 phase, 60 cycles, 150 r.p.m.

Exciter, Allis-Chalmers-Bullock. Rating 104 amps., 120 volts, 1000 r.p.m.

Full particulars may be obtained on application to E. Hanson, City Electrical Engineer, Saskatoon.

Offers, endorsed on outside of envelope "Offer for Engines, Generators and Boilers," should be addressed to the City Commissioners, Saskatoon.

F. E. HARRISON, Mayor,
Chairman of Commissioners.

Saskatoon, March 5th, 1913. 6-7

Situations Vacant

WANTED—Hydrauli and Electrical operators and maintenance men for large power plant in the East. Permanent position with good prospects of advancement for the right men. Plant in small town located directly on the railroad, one hour railroad distance to larger city. Applications with full particulars to be sent to Box 738, Electrical News, Toronto, Ont. 6-7

WANTED—Operators familiar with A.C. Generators. Box 751, Electrical News, Toronto, Ont. 7-9

First-class meter man, capable of repairing and calibrating house and power meters, also making motor tests. State experience and salary expected. Northern Ontario Light & Power Company, Ltd., Cobalt, Ont. 4-7

Situations Wanted

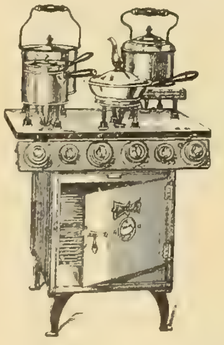
Electrical engineer, four years works experienced tester, four years operation of sub-stations, steam and hydraulic power house, wants position in charge of plant. Married. Best references. Box 752, Electrical News, Toronto, Ont.

Technical graduate, familiar with plant design, seeks position connected with design or construction of hydro-electric power plant; around Montreal preferred. Would like to start as designing draughtsman under supervision. Has followed engineering apprenticeship course with best manufacturing company. Speaks English and French. Best of references. Apply Box 749, Electrical News, Toronto, Ont. 7

Moonlight Schedule for April, 1913

Courtesy of the National Carbon Company, Cleveland.

Date.	Light.	Date.	Extinguish.	No. of Hours
Apr. 1	6 50	Apr. 2	5 00	10 10
2	6 50	3	5 00	10 10
3	6 50	4	5 00	10 10
4	7 00	5	5 00	10 00
5	7 00	6	4 50	9 50
6	7 00	7	4 50	9 50
7	7 00	8	4 50	9 50
8	7 00	9	4 50	9 50
9	7 00	10	4 50	9 50
10	7 00	11	4 50	9 50
11	10 10	12	4 50	6 40
12	11 40	13	4 50	5 10
14	0 30	14	4 40	4 10
15	1 10	15	4 40	3 30
16	1 40	16	4 40	3 00
17	2 10	17	4 40	2 30
18	No Light	18	No Light	
19	No Light	19	No Light	
20	No Light	20	No Light	
21	7 10	21	9 40	2 30
22	7 10	22	10 50	3 40
23	7 10	24	0 10	5 00
24	7 20	25	1 10	5 50
25	7 20	26	2 00	6 40
26	7 20	27	2 40	7 20
27	7 20	28	3 20	8 00
28	7 20	29	3 40	8 20
29	7 20	30	4 10	8 50
30	7 20	May 1	4 20	9 00
	Total Hours			189 40



More Simplex Electric ranges, Electric irons, etc. will be used this year than ever before.
You want to sell your proportionate share. Educate your customers early in Simplex goods before motor trips and other outdoor "distractions" make them harder to interest.
You want enough Simplex appliances to make an impressive display.

Send in your order now

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for your streets, factory, warehouse or yard
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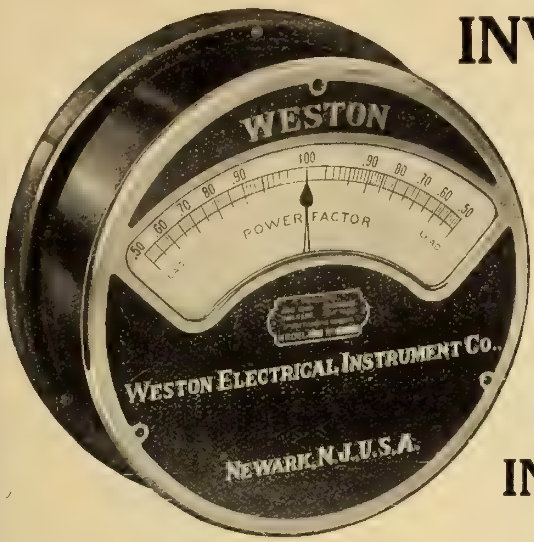
"Consult A Specialist"



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Chicago, 1504 Monadnock Blk.
Boston, 176 Federal Street.
Philadelphia, 342 Mint Arcade.
Birmingham, Brown Marx Bldg.

Detroit, 44 Buhl Block.
St. Louis, 915 Olive Street.
Denver, 231 15th Street.
San Francisco, 682 Mission St.
Cleveland, 1729 E. 12th Street.

Toronto, 76 Bay Street.

Winnipeg, Montreal, Calgary, Vancouver } Northern Electric & Mfg. Co.

London, Audrey House, Ely Place, Holborn.
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Johannesburg, So. Africa, F. Peabody Rice, Standard Bank Building, Harrison St.

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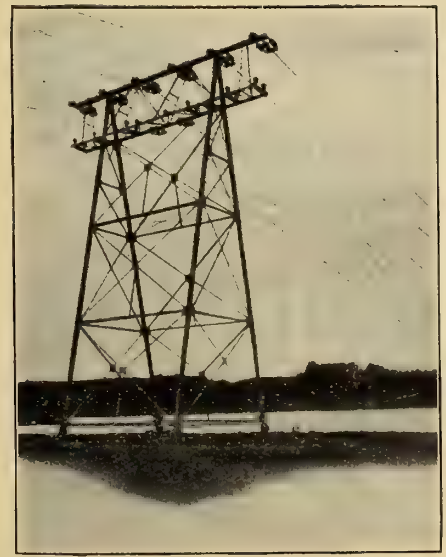

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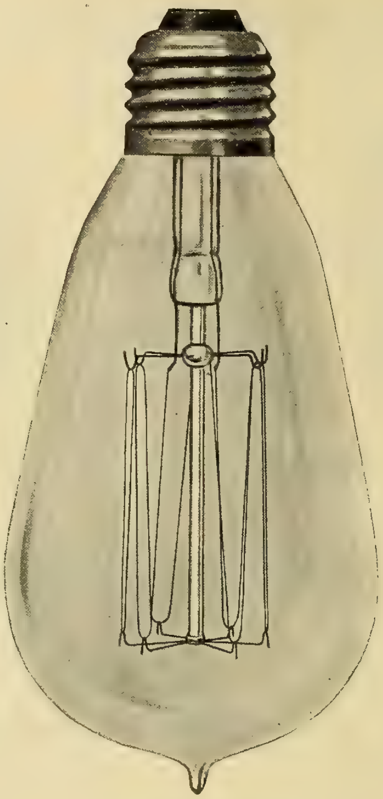

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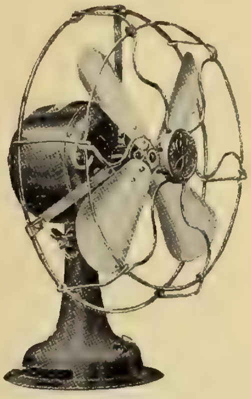
Electric Fans

1913



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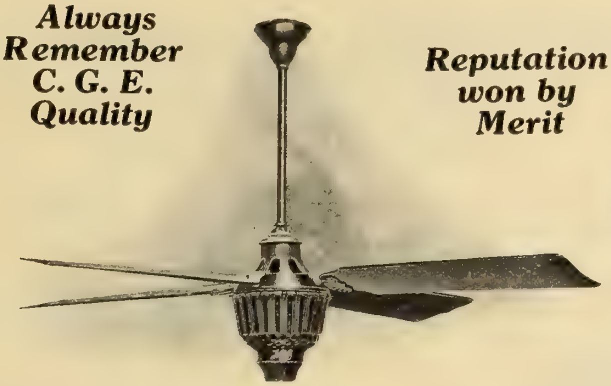
Always Remember C. G. E. Quality



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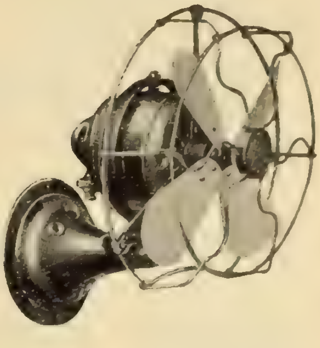
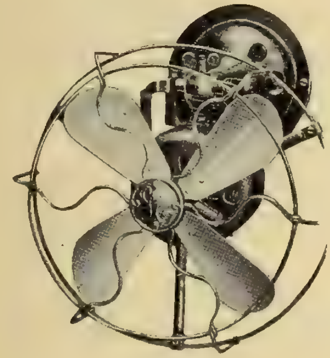
Reputation won by Merit



Oscillating Bracket Fan



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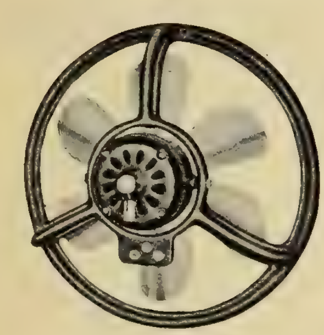
Our 1913 Fans are thoroughly representative of both **merit** and **quality** and well worth your careful consideration.

We suggest that you endeavour to **anticipate your requirements** well in advance—Place your orders **early** and not be caught without stock when the warm weather arrives.

Our nearest district office will be pleased to give you **new** descriptive matter and **latest** prices.



Ventilating Fan

Canadian General Electric Co., Limited

Head Office: TORONTO

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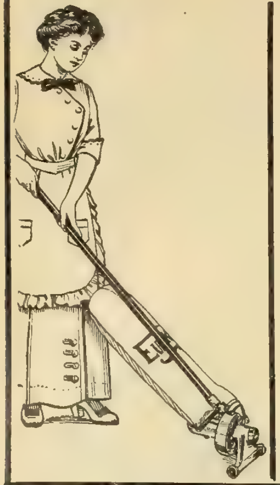

"EUREKA" Electric Suction Cleaner

The best and most practical Vacuum Cleaner ever invented, barring none, regardless of price. The Eureka is equipped with the famous Eureka type Motor that has been known for its remarkable perfection for years. The wheels on the nozzle, exclusive with the Eureka, make the machine very easy to operate. Send for sample and be convinced. **Retail Price $45.00**

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WE beg to announce the opening of our new premises at above address where every facility is installed for the rapid handling and repair of any electrical apparatus. Prompt attention, expert advice, with reliable repair, is given to the smallest as also the largest enquiry.

OUR MOTTO IS : — **"Rapid, Reliable, Repairs"**

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Yours etc., etc.
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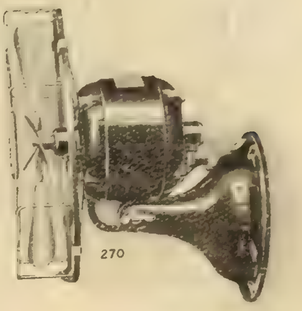
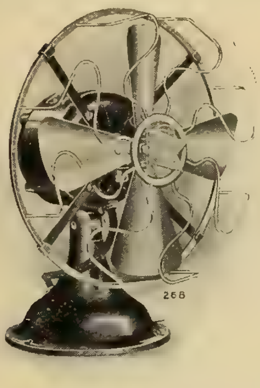
A Live Fan Proposition For Live Dealers !

This will be a bigger "Standard" Fan season than ever before. Hundreds of wide-awake electrical dealers who have seen the demand for "Standard" Fans grow amazingly from year to year have already sent in their orders. If you haven't made your arrangements for "STANDARD" Fans for the coming season, we'd advise writing for our proposition without delay.



Robbins & Myers "STANDARD" Fans



made in a full assortment for either direct or alternating current. We have just perfected a splendid seller for home use, a new induction type 8-inch Fan, finished in a superb black enamel with guard and blades in brushed brass as the standard, or finished entirely in any of the popular plated finishes, or in white enamel—whatever finish may be desired.

Write for full details concerning "Standard" Fans and facts about our liberal plan for dealers.

THE ROBBINS & MYERS CO.
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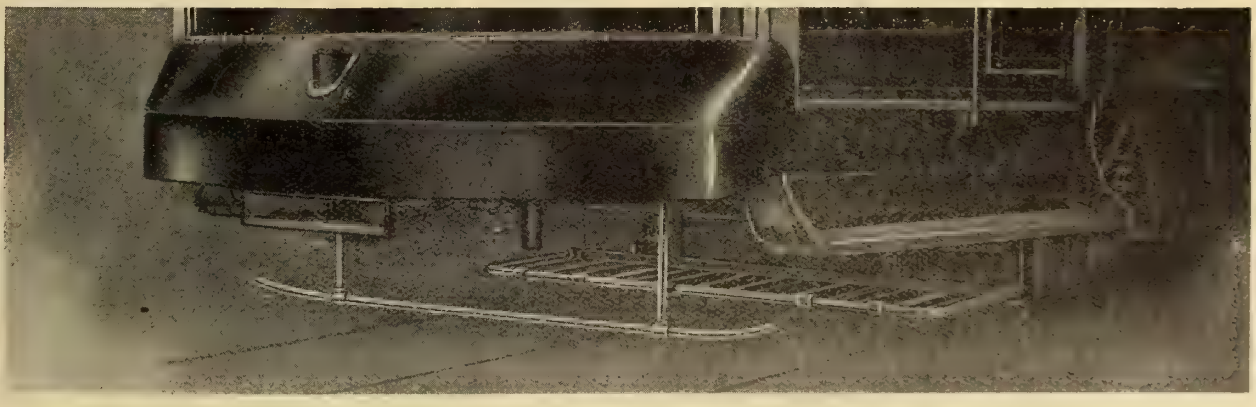
We also manufacture a complete line of small D. C. and A. C. Motors for all purposes.

The Parmenter Automatic Wheel Guard

FOR STREET CARS



Arrangements for the manufacture of these wheel guards have been made with the Schofield-Holden Machine Co., Ltd., Toronto, Canada, under Canadian Patent No. 131,381 Dated Feb. 28, 1911 and can be seen in operation at their factory 2 Carlaw Ave., Toronto.
These wheel guards are attached to the truck of the car and are absolutely automatic, always follow the rail whether on curve or straight track.

For Full Particulars Address

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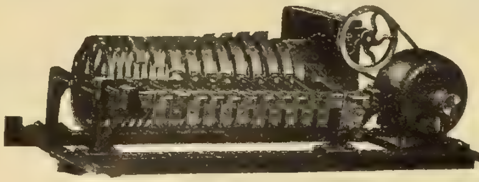

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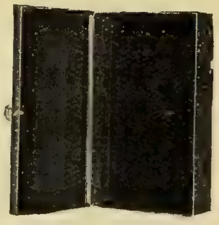
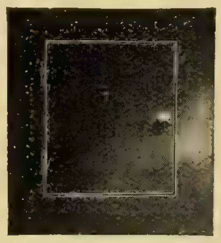
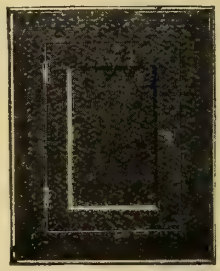


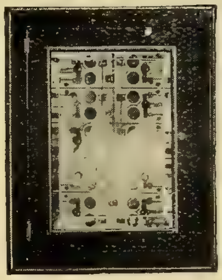
Type A—The usual box dust tight cover



Type P—A medium price box with a door and trim



Type C—A high-class one, beaded and paneled



Type G. With a beveled plate glass panel in door.

Type SW. Steel, with natural oak, mahogany or walnut finish.

Bushing for all Knockouts

Save money by getting aquainted with the line.

Write to-day.

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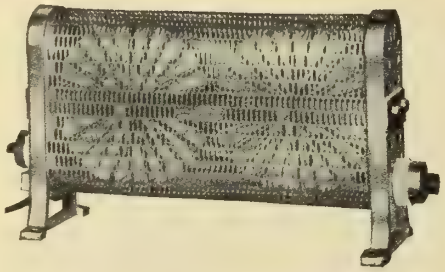
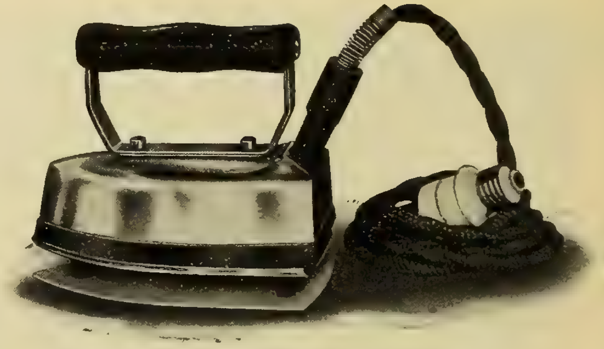
ROYCE & CO.



Royce Patent "Economic" Electric Radiators



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THE "Economic" line of electric heating devices is a most profitable line to handle. They bring a good profit to the dealer or central station and are practically indestructible. The "Economic" heating element will carry a 100% overload without burning out—if operated on rated voltage it should **never** burn out.

In addition to the iron and radiator illustrated here, the "Economic" line includes Disc Stoves, Water Urn Heaters, Tailors' Irons, Car Heaters, etc. *Send for prices and particulars.*

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Superior

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Superior

This includes: Washington Fir not less than 85% heart, Georgia Pine—Long Leaf—not less than 75% heart Kyanized—Spruce. Pins and Line Hardware—A T and T specifications.

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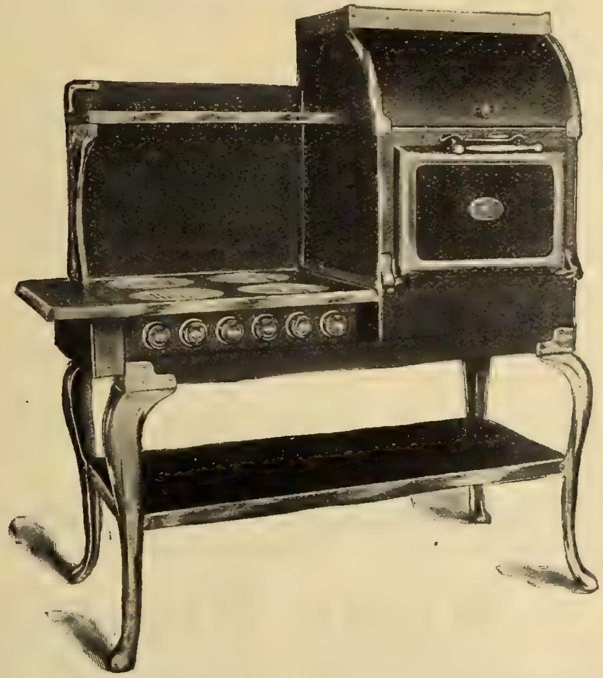

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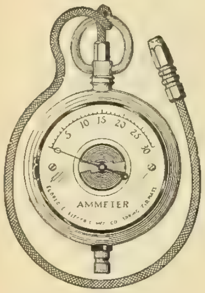

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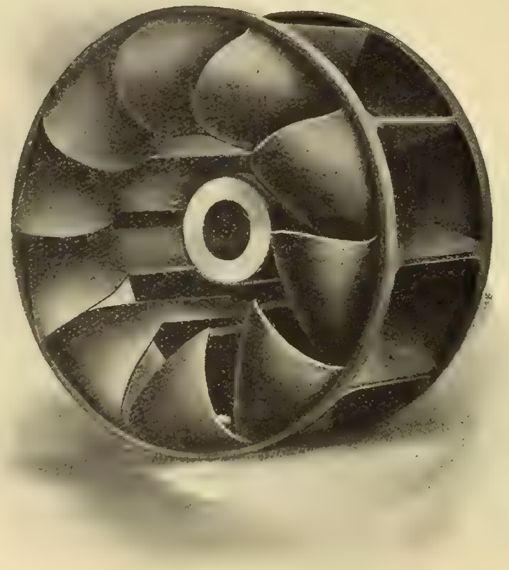

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Conserve the Water Powers.

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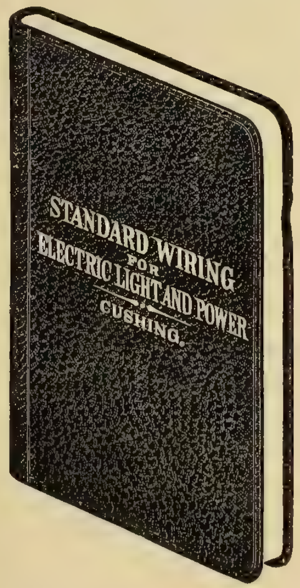

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and
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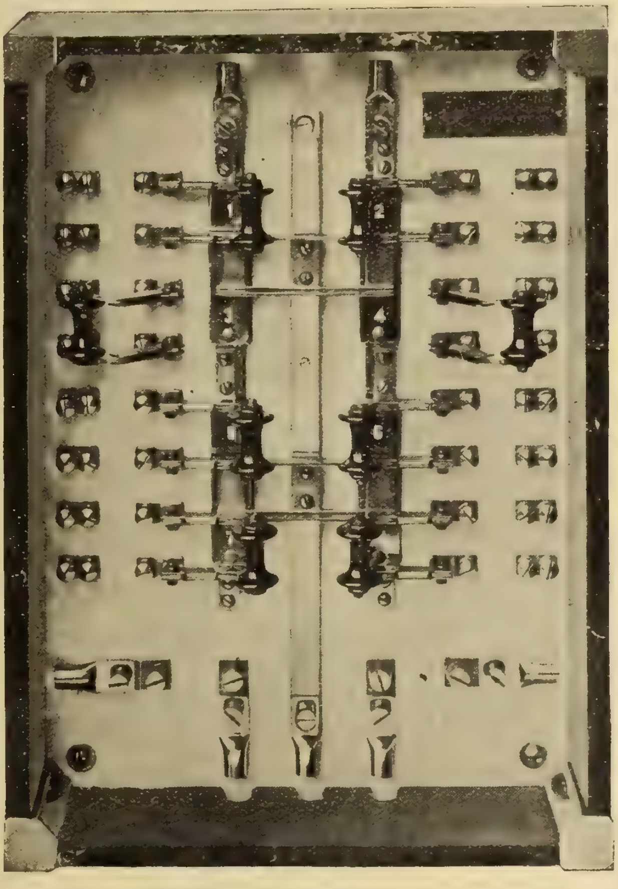

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Because "Krantz" Switch Boards and Panel Boards are the recognized standard, always reliable and comply with every requirement of the Underwriters' Association.

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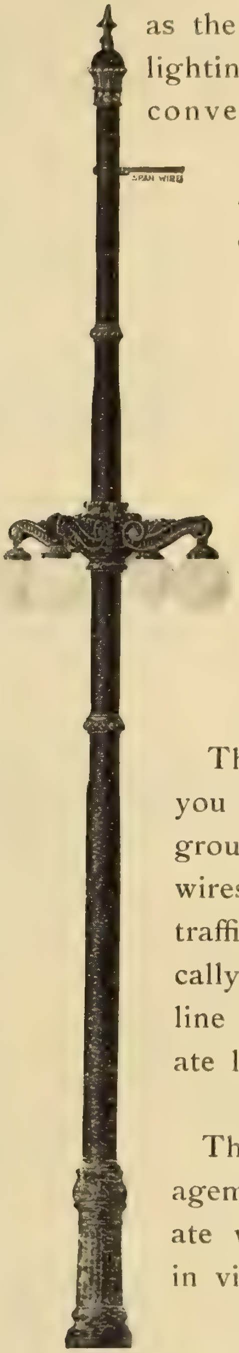

as the basis of your new street lighting system. You can easily convert them into attractive Mazda Lamp Standards or arc lamp supports by use of

**ERECO
Combination
Railway
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Fixtures**

This system, besides saving you the expense of underground construction, gets the wires up out of the way of traffic, where they are practically unnoticeable and the curb line is not crowded with separate lighting standards.

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Design No. 10015.

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N.Y. Office, 90 West Street

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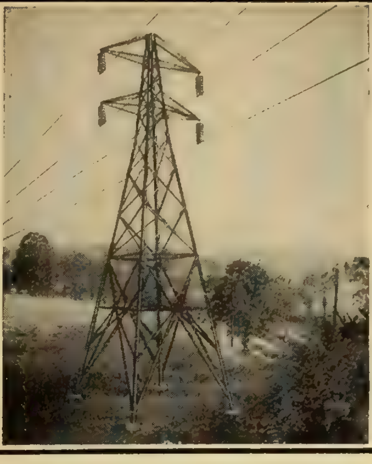

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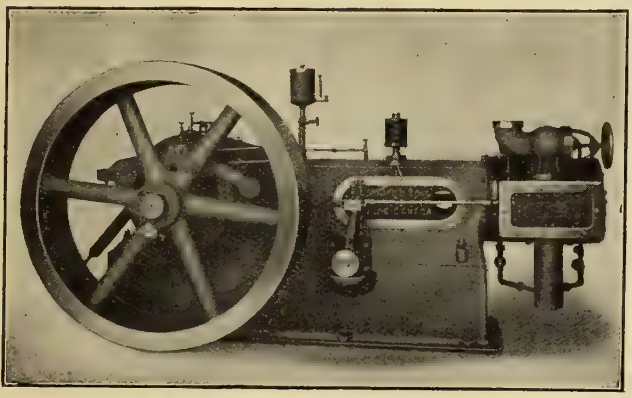

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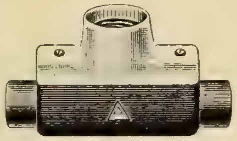

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Front view showing 3-wire cover attached

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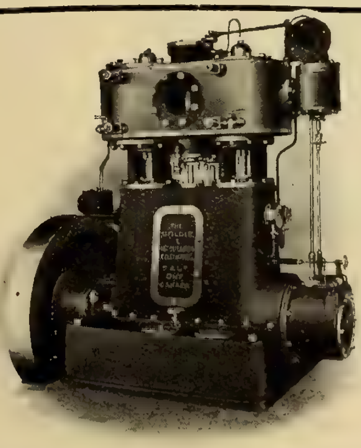

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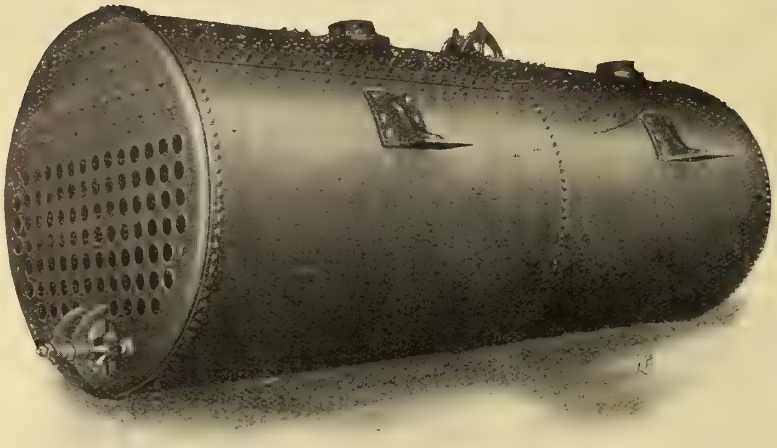

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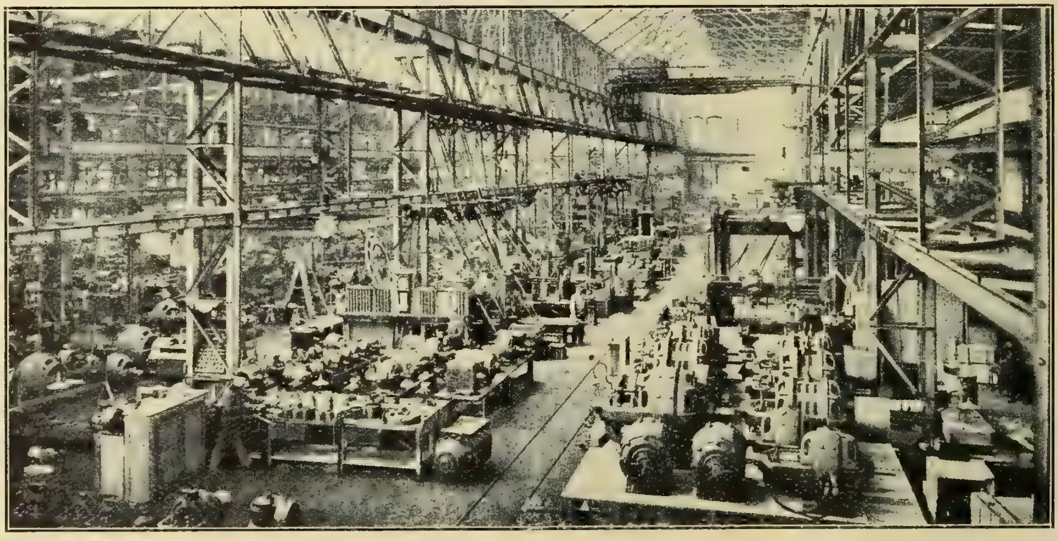

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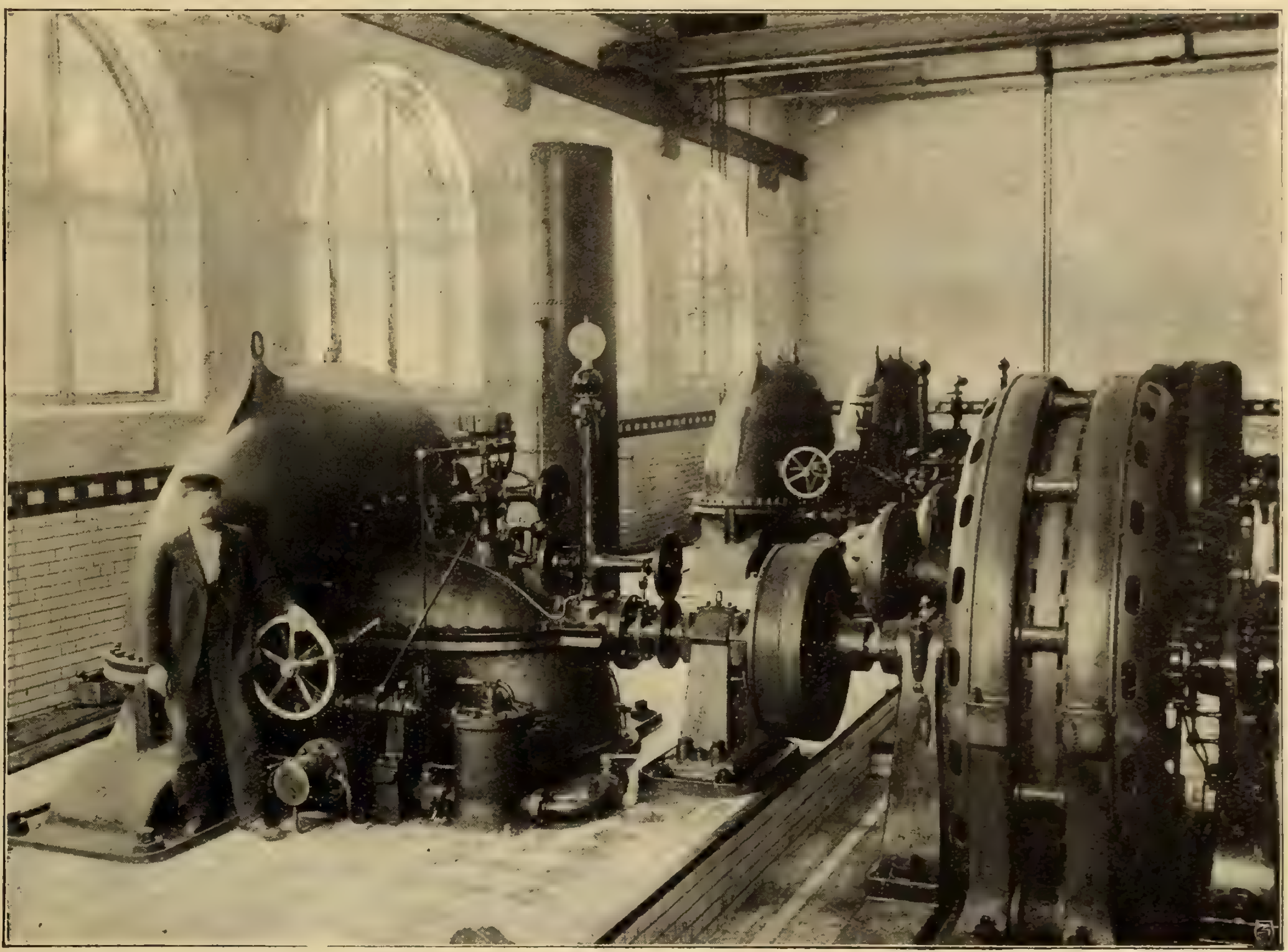

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Net head 42 metres. Three generator turbines each 900 B. H. P., normal speed 500 r. p. m. Two exciter turbines, output 500 B. H. P. each, normal speed 800 r. p. m.

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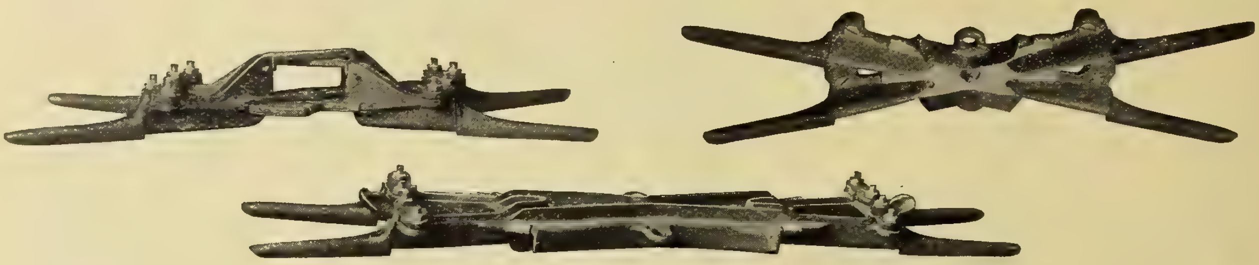

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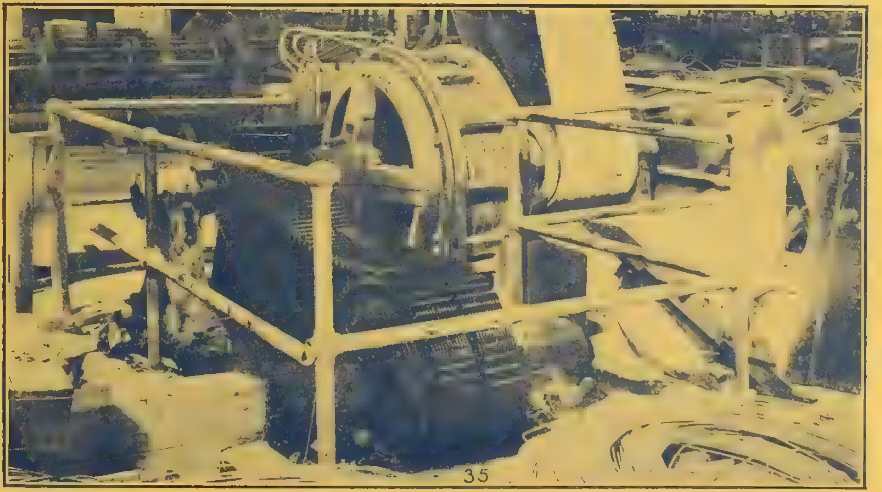

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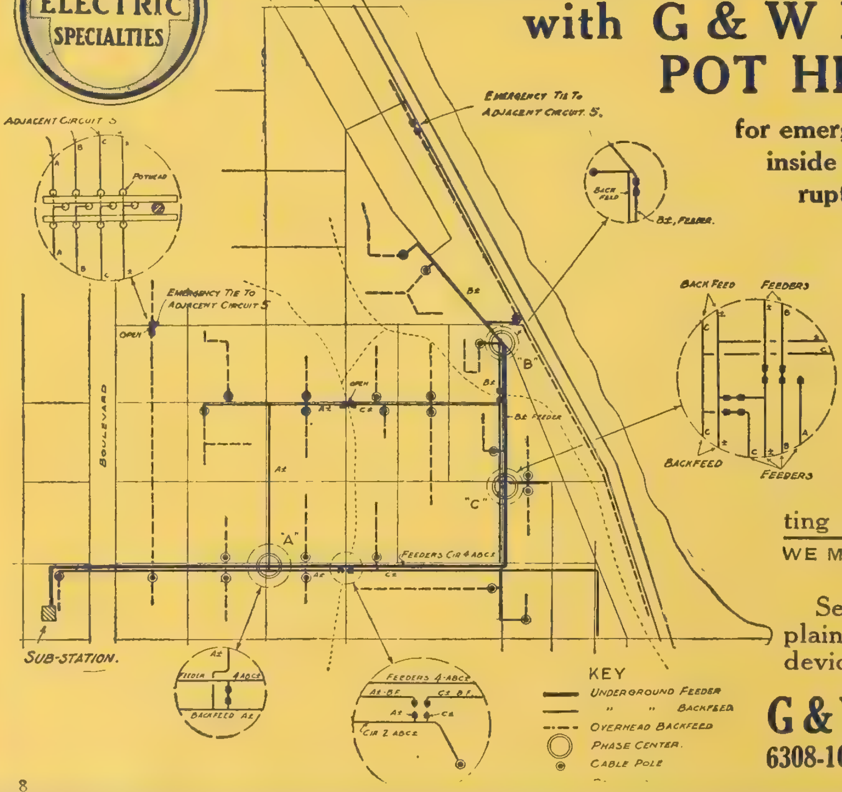

THE diagram herewith shows the application of G & W Type "S" Detachable Pot Heads to underground circuits.

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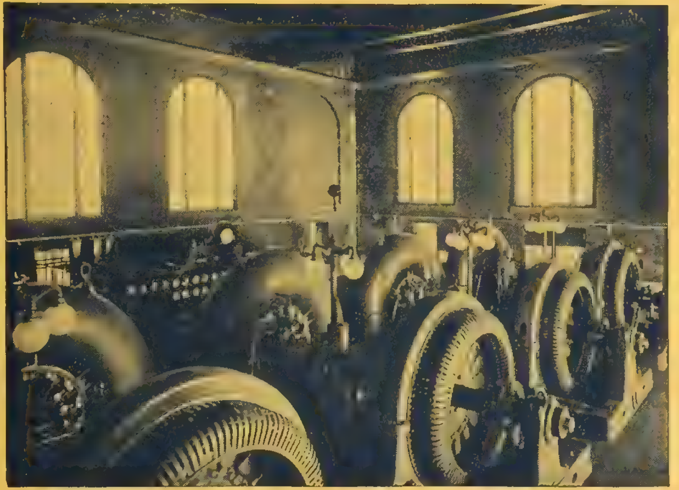
6308-10 Washington Avenue, CHICAGO

Vol. XXII—No. 8 Toronto, April 15, 1913

Electrical News

Generation, Transmission and Application of Electricity



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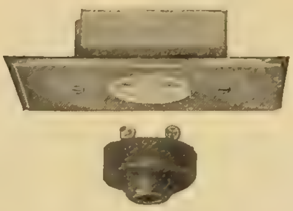

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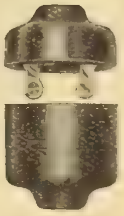

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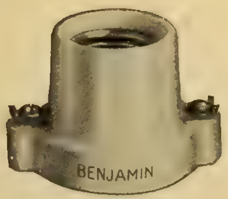

Cat. No. 9171
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Cat. No. 1105
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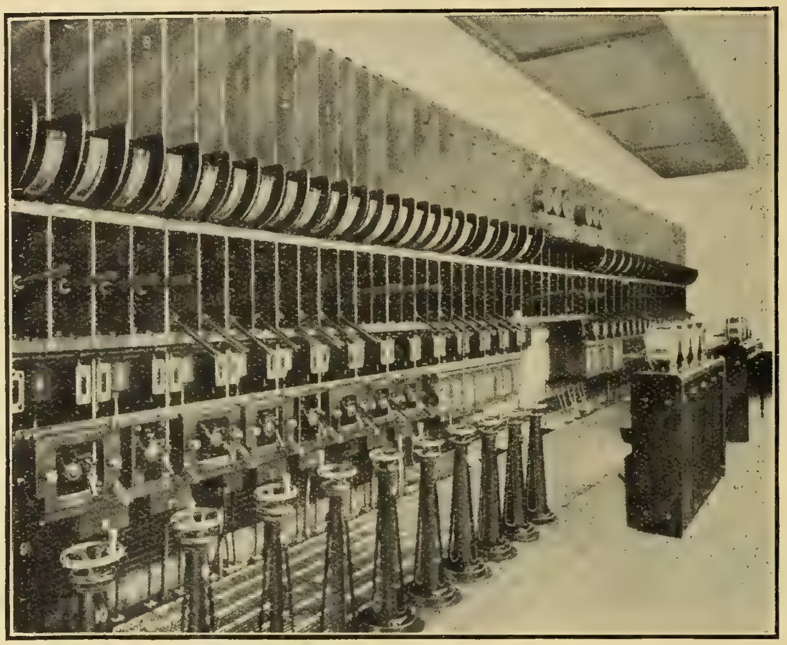

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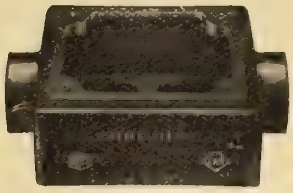
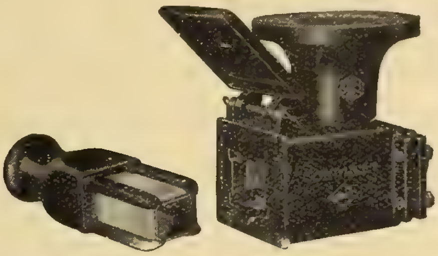
Type CLOC—For use with Centre Ceiling Fittings.

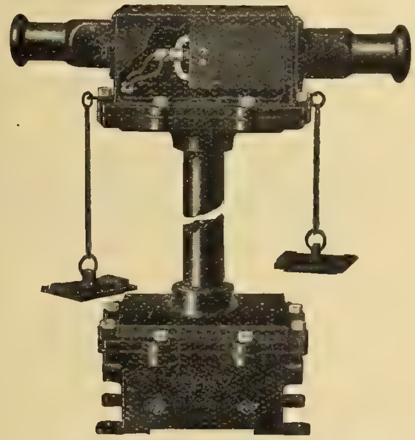

Type JRR—For use back of Moulding with Rectangular Base Fittings.

Type DSOC—For Deck Sill Outlets. Takes Round Base Fittings.

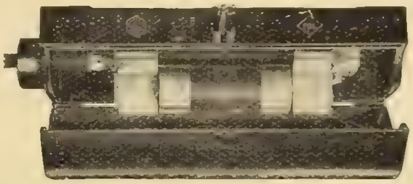
Type MD—Receptacle and Plug for Dynamo-Regular Connection.


Type BRHS with 100 Ampere Receptacle and Plug. Battery Charging Equipment for Car.

Type PJCA—Medium Size Weatherproof Junction Box.


Type UGC—Arranged as Yard Charging Equipment for Underground Conduit System.

Two-Hub Side Plate for Type RS Condulet.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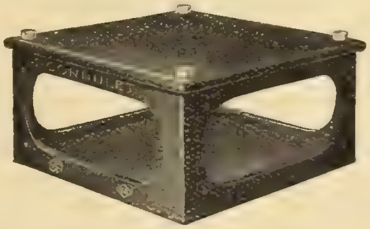
The Condulets shown here are only a few of the many types designed to simplify and improve conduit installations in railway cars, buildings and yards. Whatever the requirement, we have a Condulet to meet it.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2013

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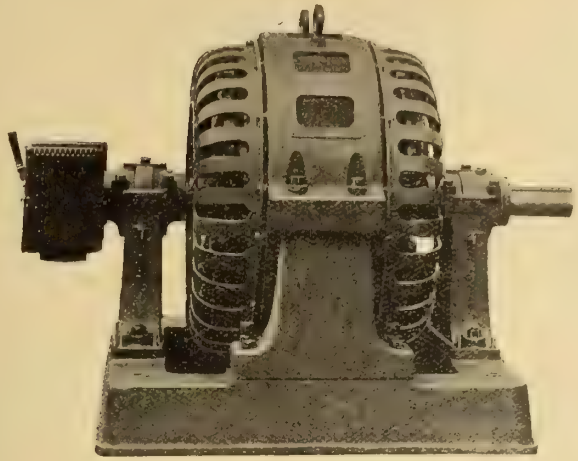

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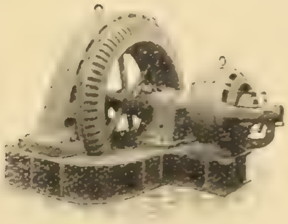

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Condulets from 2 inches down to one-half inch.
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Toronto, Ontario

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"GALVADUCT"

AND

"LORICATED"

Judge Travis Block, Calgary— A "Galvaduct" Building

The above two conduits will be found in most of the large and important buildings in Canada as well as in many private residences and various other classes of buildings.

"GALVADUCT"—The most perfect interior construction conduit on the market, recognized as the standard of high quality.

"LORICATED"—A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive Agents.

Specify these Conduits

If your jobber cannot supply you—Write us.

Conduits Company

Limited

Toronto - Montreal

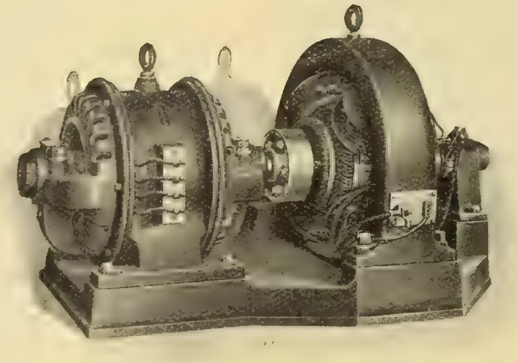
The Lachute Shuttle Co., Limited

Lachute Mills—P.Q.

Manufacturers of

Cross Arms—Space Blocks—Birch and other Hardwood Insulator Pins and Brackets.

Special Machines



When in need of any special electrical apparatus or repairs to defective motors or generators, write us.

We are fully equipped.

Toronto & Hamilton Electric Company

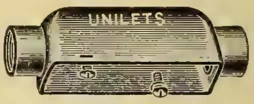
HAMILTON

DRAWN STEEL

UNILETS

RECTANGULAR STEEL UNILETS

Type No. 1



Type No. 2

Everything needed by the Contractor in the way of conduit fittings is included in the

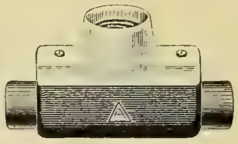
Appleton Line

and is described and listed in the No.6 Appleton catalog Send for copy at once and have first hand information about

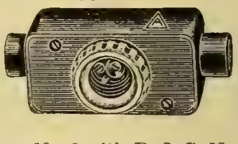
UNILETS

the ideal outlets for concealed or exposed conduit work and about other Appleton specialties needed for up-to-date conduit work.

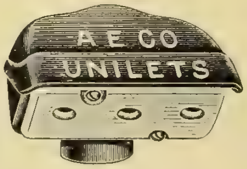
Write for the catalog today



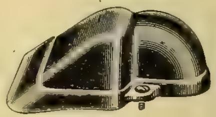
Type No. 2 with Appleton No. 7650 Receptacle attached

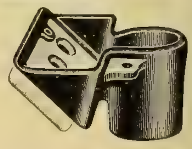


Type No. 2 with P. & S. No. 577 Receptacle attached



Front view showing 3-wire cover attached





Top part removed

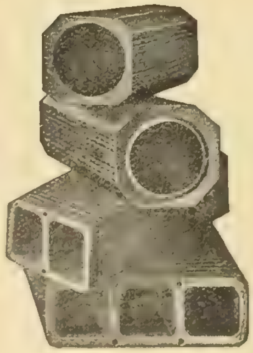
Appleton Entrance Unilets—Black, Enamel or Sherardized Finish. Top part removed while drawing wires and making connections. Absolutely waterproof for ½ ihch to 4 inch conduit.

APPLETON ELECTRIC CO.

212 North Jefferson St. - - CHICAGO, ILL.

FOR SALE BY

Chapman & Walker, Ltd., Toronto. The Mainer Electric Co. Ltd., Winnipeg. Marshall Wells Co. Ltd., Winnipeg Montreal Electric Co. Ltd., Montreal.



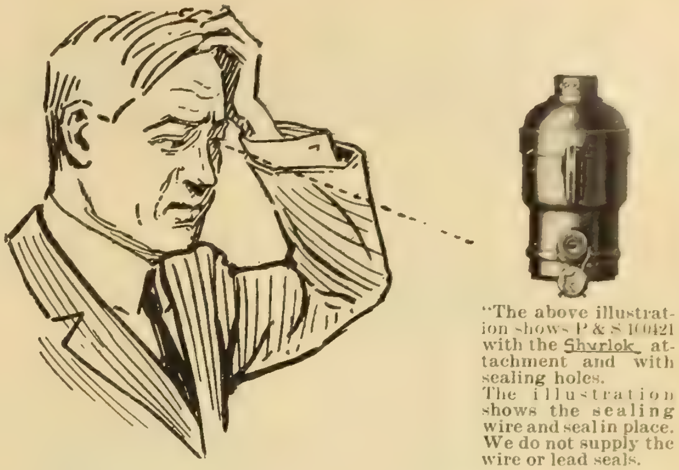
Clermont Sewer Pipe Co.

Multiple and Single Duct Conduit for Underground Work

We challenge the world on finish and durability of our material. Our plant is located giving us the lowest freight rates to Canada.

B. S. BARNARD, Vice-Pres. 50 Church St., New York City

"This sealable Shurlok makes lamp thieves think twice"



"The above illustration shows P & S 10421 with the Shurlok attachment and with sealing holes. The illustration shows the sealing wire and seal in place. We do not supply the wire or lead seals.

and then decide not to try to remove lamps from sockets so protected.

Perhaps you Central Stations who have rental cluster service want even greater protection than is given by the ordinary form of Shurlok.

The illustration herewith shows how it is possible for you to attach your private seal, which will show at a glance whether or not anyone has attempted to tamper with the lock even though they have been unsuccessful.

There will be no additional charge for supplying Shurlok sockets with these holes for sealing, but they will not be so supplied unless so ordered.

In ordering Shurlok sockets of this description, add the words "with sealing holes."

Send for Free Booklet

"FOR SALE BY ALL JOBBERS"

Carried in Stock by:

John Starr, Son & Co., Limited	**Halifax**
St. John Railway Company	**St. John N. B.**
Mechanics Supply Company, Limited	**Quebec**
Dawson & Company, Limited	**Montreal**
Central Electric & School Supply Company	**Toronto**
Mainer Electric Company	**Winnipeg**
Dawson & Company	**Winnipeg**
General Supplies Limited	**Calgary, Alta.**
Cope & Son	**Vancouver**

Pass & Seymour, Inc.

MAIN OFFICE AND WORKS: SOLVAY, NEW YORK, U. S. A.

New York City, 178 Fulton Street San Francisco, Rialto Building

Chicago, 700 West Jackson Blvd.

PASS & SEYMOUR, Inc., Solvay, N. Y.

Please send free copy Shurlok Booklet and Catalog 20

Name ....

Address ....

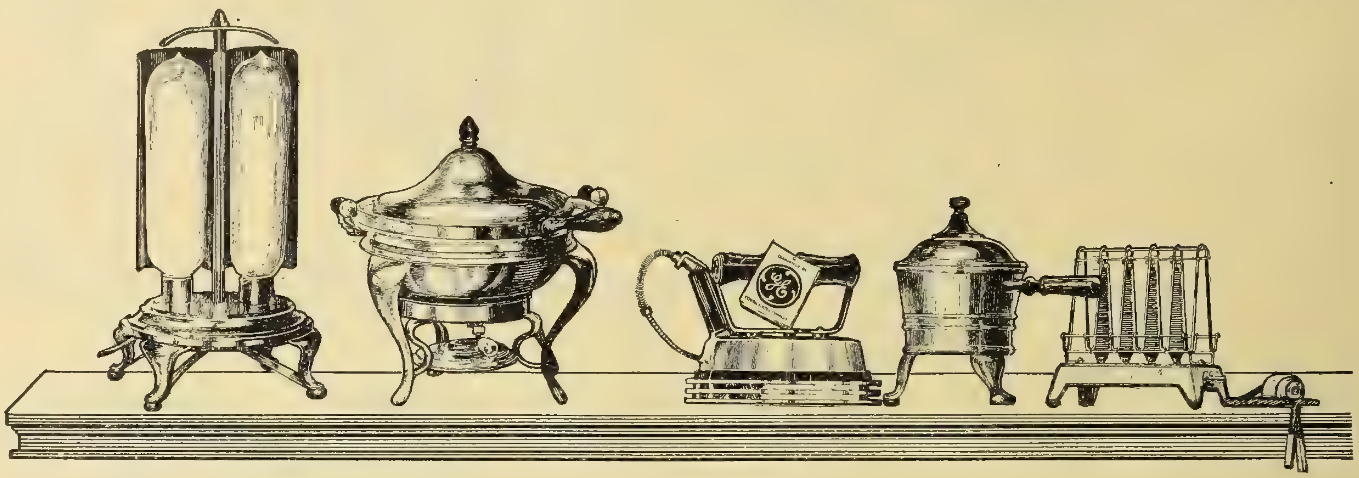
City ....

State ....

Coupon No. 111

Electrical Household

THE NEWEST AND



ELECTRIC Chafing Dishes, Percolators, Flatirons, etc., belong on every dealer's shelves and sooner or later you will have to stock **C.G.E.** devices to keep your best customers from going elsewhere for them.

Begin now, before your customer gets out of the habit of expecting you to carry **C.G.E.** Heating and Cooking Appliances.

It is easy to sell a well-known article of excellence like "The Guaranteed **C.G.E.** Iron" simply by letting the public realize that you handle it and are pushing its sale.

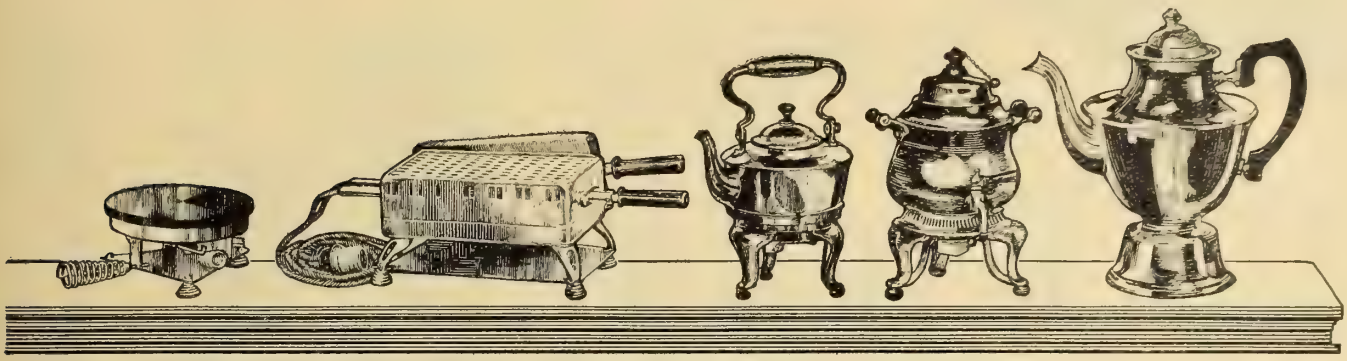
Canadian General Electric Co., Limited

Head Office: TORONTO

Montreal Halifax Ottawa Cobalt Porcupine Winnipeg Regina Saskatoon
Calgary Edmonton Vancouver Victoria Nelson Prince Rupert

Heating and Cooking

MOST PROFITABLE LINE



IF you have never used a **C.G.E.** Toaster, order a sample and take it home, let the family use it every day for a month. Then try to take it back to the store—the chances are you **could not** if you so wished.

From this trial you will get all the talking points needed to sell **C.G.E.** Toasters.

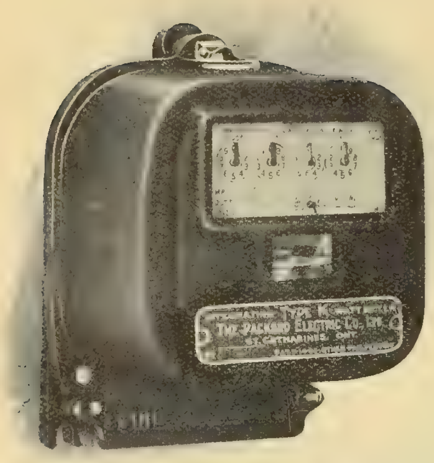
The proof of this Toaster's permanent popularity is **tasting** the toast it makes.

Write Our Nearest District Office for Prices and Descriptive Printed Matter

Canadian General Electric Co., Limited

Head Office: TORONTO

Montreal Halifax Ottawa Cobalt Porcupine Winnipeg Regina Saskatoon Calgary Edmonton Vancouver Victoria Nelson Prince Rupert



Metal Case
Type K

For
Permanent Accuracy
and Reliability
use

PACKARD
METERS

DERANGEMENT or inaccuracy of meters means either a loss of dollars to the central station or dissatisfaction to its customers, both of which conditions must be avoided.

The Packard Company, the first company in Canada to manufacture induction meters, at the very beginning recognized the importance of the Watthour meter, both in its relation to the central station and to the customer. Its meters have been for many years, acknowledged by electrical men who know, as the standard for accuracy, reliability and permanence.

Large stocks carried at—
St. Catharines and Winnipeg
St. John Railway Co., St. John, N.B.
General Supplies, Limited, Calgary, Alta.

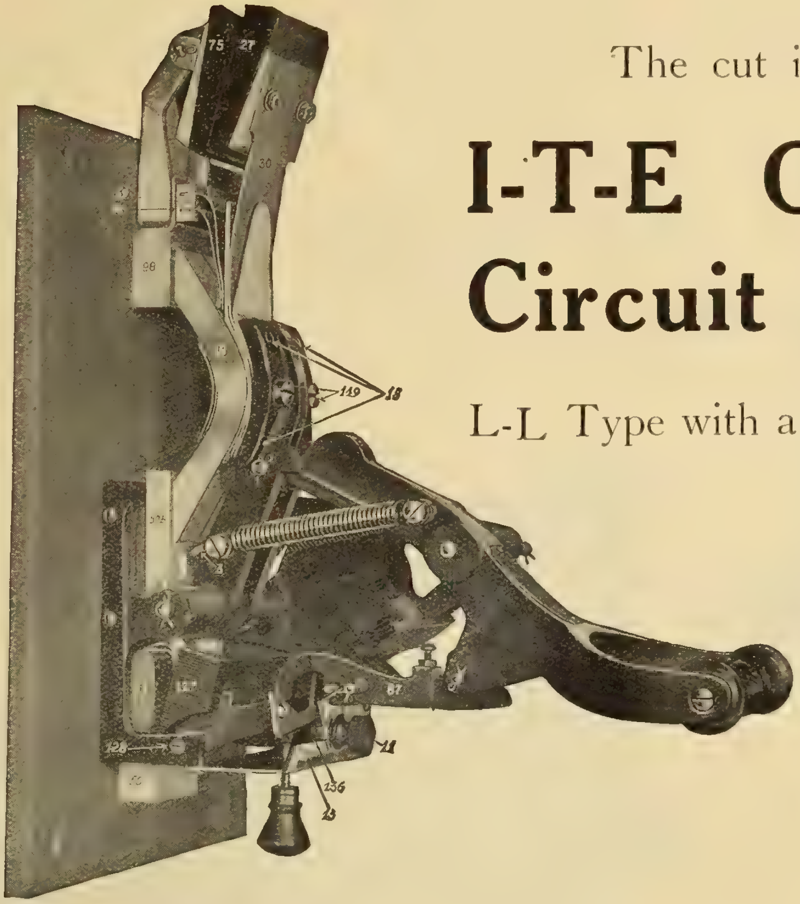
The Packard Electric Company, Limited

Factory at—ST. CATHARINES

General Sales Office
901-902 Traders Bank Building, Toronto
N. W. Office and Warehouse, Winnipeg

Type PK
Polyphase

Perhaps no one piece of electrical apparatus is more widely used than the I-T-E Circuit Breaker. Certainly none has a higher reputation for effectiveness and reliability.



The cut illustrates an

I-T-E Overload Circuit Breaker

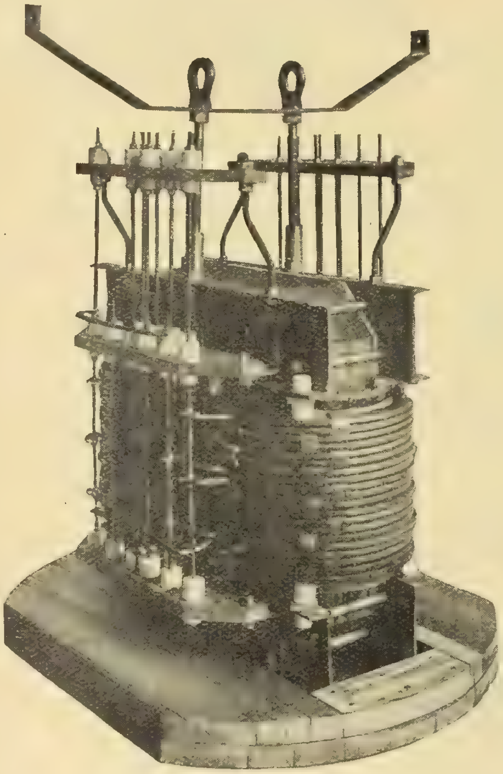
L-L Type with a part of the housing removed, showing the admirable simplicity of the working parts.

For more detailed information as to this and other types of I-T-E Circuit Breakers see the new I-T-E CIRCUIT BREAKER HAND BOOK.

THE CUTTER COMPANY, Main Office and Factory PHILADELPHIA

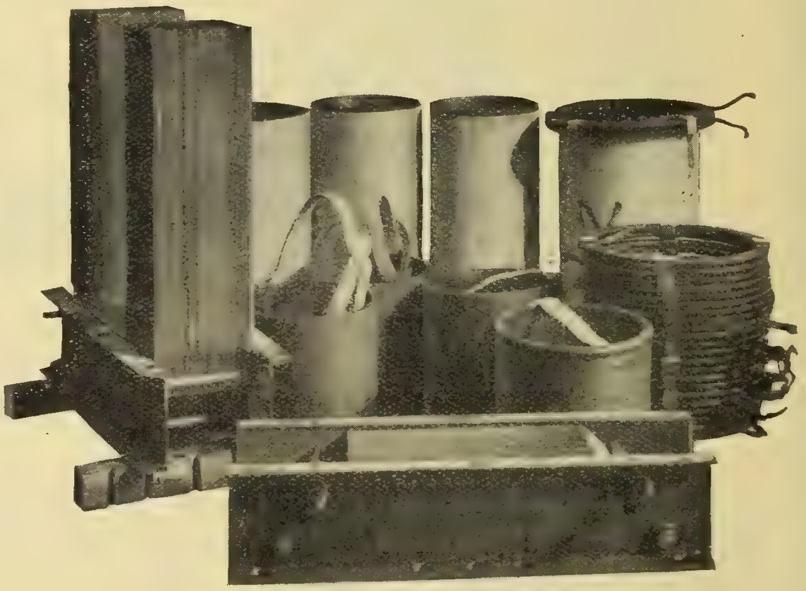
W. C. Jessup, 120 Liberty Street, New York City.
H. F. Darby, Jr., 1501 Monadnock Block, Chicago, Ill.
H. W. MacVaugh, 1122 Park Building, Pittsburgh, Pa.
Thos. E. Beasley, 751 Ellicott Square, Buffalo, N.Y.
C. E. Wise, 427 Ford Building, Detroit, Mich.
Eccles & Smith Co., 71 First Street, San Francisco, Cal.
Eccles & Smith Co., 524 S. Los Angeles St., Los Angeles, Cal.
Eccles & Smith Co., 68 First Street, Portland, Ore.
Electric Manufacturers' Sales Co., Tramway Bldg., Denver, Col.
I-T-E Electric Co., 72 Finsbury Pavement E.C., London, Eng.

Butt Joint Core Type Transformers



Note the arrangement for holding the core centered in the tank so that the transformer can be shipped complete in its case ready for immediate service.

Note also the strong mechanical arrangement of both H. V. and L. V. leads from coils to terminal board.



Note how easily the butt joint core type transformer is dismantled. The edges of punchings meet but do not overlap, and the top yoke can be quickly removed in case of injury to any of the coils.

Note the highly insulated H. V. coils so assembled as to expose the entire surface to the cooling

WORKS - - - MONTREAL

ALLIS-CHALMERS-BULLOCK
LIMITED

Sales Offices: MONTREAL, 613 Canadian Express Co. Bldg. TORONTO, 810 Traders Bank Bldg.
WINNIPEG 601 Builders Exchange Bldg. VANCOUVER, Dominion Bldg.
COBALT CALGARY

HAVE YOU ORDERED A SAMPLE SET?

Tungstolier De Luxe

Set No. 1

Absolutely the best value and handsomest set of fixtures ever offered for the money—packed in one box.

Do not let the offer go by without taking advantage of it.

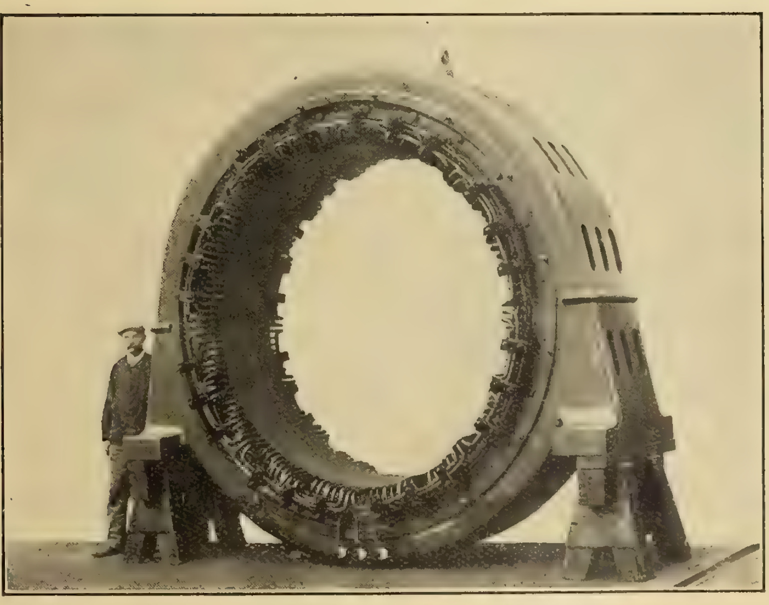
Write for ¼ size drawings and net prices.

The Tungstolier Company
of Canada, Limited

Head office: 212 King Street West, Toronto

Engineering Works of Canada, Limited

Head Offices: NEW Birks Building, MONTREAL, QUE.



"Stator of 2,500 KVA Generator, 375 R.P.M."

Descriptive Pamphlet of our Generators mailed upon request

Builders under the patents of the
Societe Alsacienne
Belfort, (FRANCE) Mulhouse, Grafenstaden (GERMANY)

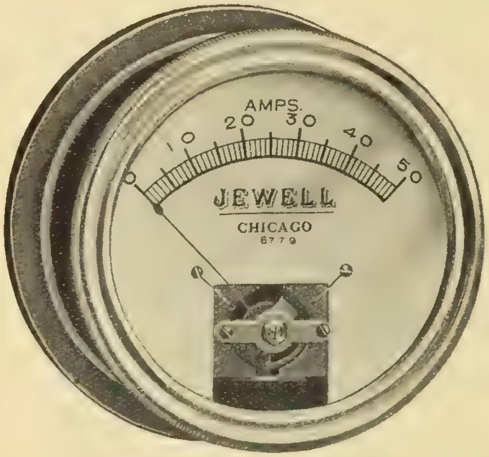
ESTABLISHED 1826

Power Plants, Rolling Mills, Mining and Hoisting Machinery

STIGLER'S
Patented Passenger and Freight
ELEVATORS

MARSHALL-DAVIS
—LIMITED—
ELECTRICAL APPLIANCES
DUNNVILLE, - ONTARIO

Agents for Jewel Electrical Company, Chicago



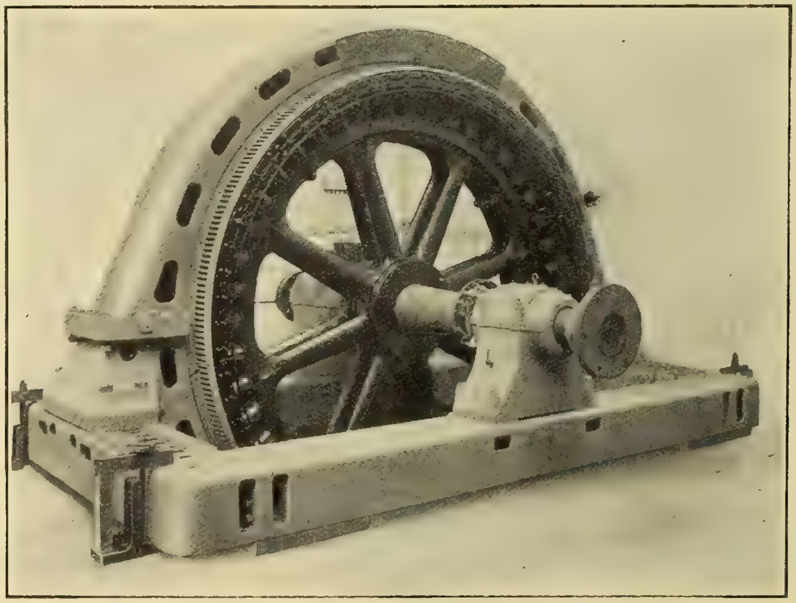
Precision Instruments
for
Switchboard, Laboratory,
Portable, Automobile,
A. C. or D. C.

An Instrument for Every Purpose

PROMPT SHIPMENTS BROAD GUARANTEE

VICKERS LIMITED
Patent Automatic Reversing Drive for Planing Machines

Complete Equipments for the electrical lighting and driving of machine shops, factories, etc.



K. W., 6600-volt, 164 R..M. 3-Phase Generator for the City of Winnipeg. Five Generators have been supplied

Turbo Generators

Motors of all types

Motor Generators

Rotary Convertors

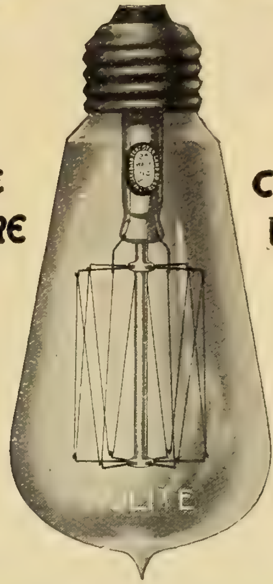
Head Office for Canada: Lewis Building, Montreal
Mr. J. F. I. Thomas (Representative)

Works:
River Don Works, Sheffield, England

"NULITE"

TUNGSTEN LAMP

GENUINE DRAWN WIRE



CONTINUOUS FILAMENT

DID YOU

read our previous ads., telling about "Nulite" tungsten lamps?

PLACE YOUR CONTRACT

with us, and guarantee yourself the majority of the Tungsten Lamp business in your district.

WITH US

it is part of our contract to supply you with neat, attractive advertising matter, at no extra cost to yourself.

YET

the only way we can actually prove to you what we do for our agents, in increasing their sales and profits is to have you give us a reasonable order and let us give you the advantages of our selling helps for one season.

WE

desire to make the biggest kind of success out of our Agencies. We want it to be as profitable and as satisfactory to them as possible. We realize that we can increase our own business only by helping to increase the business of our agents. It is therefore to our interest to work as hard as we can to make each individual agency successful.

WANT YOUR BUSINESS

Yes, we do. and if favored with it we will guarantee that your sales will increase.

A CANADIAN PRODUCT

Manufactured by The

Canadian Tungsten Lamp Co.

Limited

HAMILTON, ONT.

Branches at—
Montreal—246 Craig St. W.
Winnipeg—35 Albert St.
Vancouver—365 Water St.

USE THIS COUPON TO-DAY

The Canadian Tungsten Lamp Co., Ltd.
HAMILTON, ONT.

Name

Address

Send us full particulars of your agency contract

The Pipe

GREENFIELDUCT

of Quality

MANUFACTURED BY

GREENFIELD CONDUIT CO., LIMITED

Perfect Threads

GREENFIELDUCT

is a HOT GALVANIZED CONDUIT, both the EXTERIOR and the INTERIOR SURFACES being treated by a PATENTED HOT GALVANIZED PROCESS. Molten Zinc is wiped over these surfaces in such a manner as to produce a PERFECTLY SMOOTH FINISH and a HOMOGENEOUS COATING OF ZINC throughout.

GREENFIELDUCT

GREENFIELDUCT

is the only conduit manufactured, in which the INTERIOR and EXTERIOR SURFACES have the same treatment and finish.

GREENFIELDUCT

will withstand a test of at least SEVEN DIPS in Standard Solution of Sulphate of Copper.

GREENFIELDUCT

is inspected and labeled under the supervision of Underwriters' Laboratories, (Inc.)

¶ Other methods of treatment with Zinc of the Interior and Exterior surfaces of conduit do not afford the same Smooth Surface as does the

GREENFIELDUCT

GREENFIELDUCT

General Sales Agents

Electrical Fittings Co., Limited

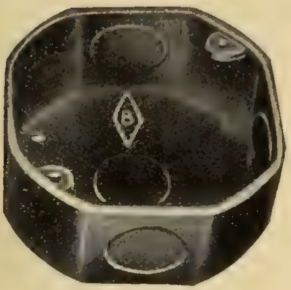
Toronto, Canada

Munderloh & Co., Limited, Montreal

John Starr Son & Co., Halifax, N.S.

Made in Canada

Iron Conduit—Conduit Boxes—Pipe Fittings and Accessories



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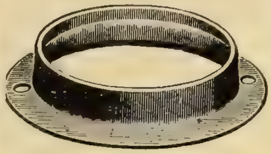

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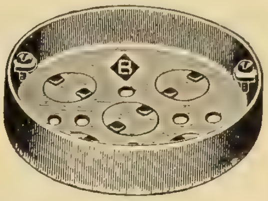

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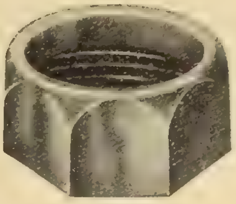
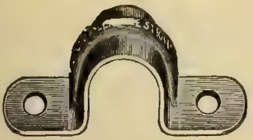
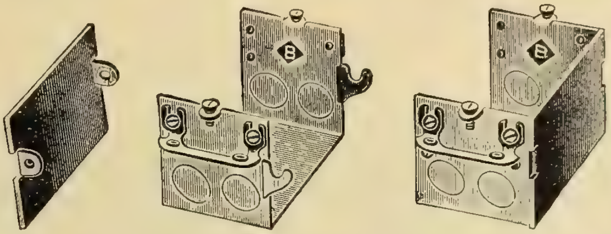
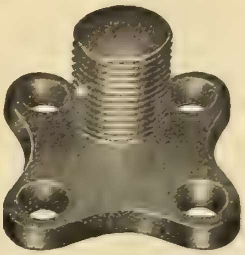






Type S C 3" deep—C C S-2" deep
side comes off and does away with carrying two gangs



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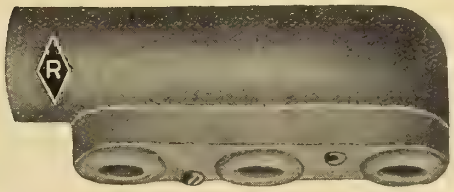
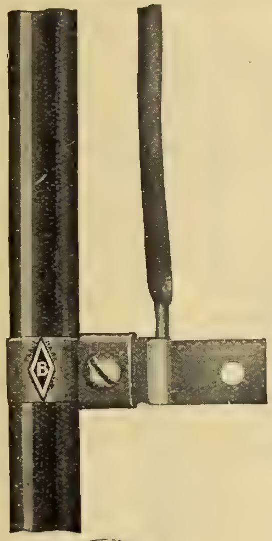
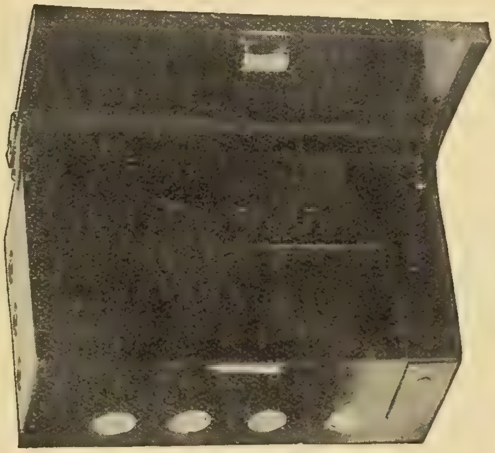
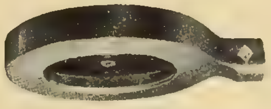


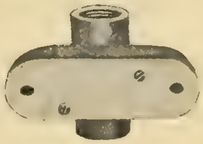




Steel Cutout Boxes

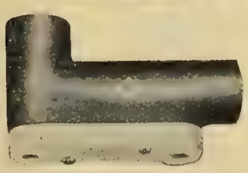


Type P



ALPHADUCT
FLEXIBLE CONDUIT
TRADE MARK
FOR ELECTRIC WIRES

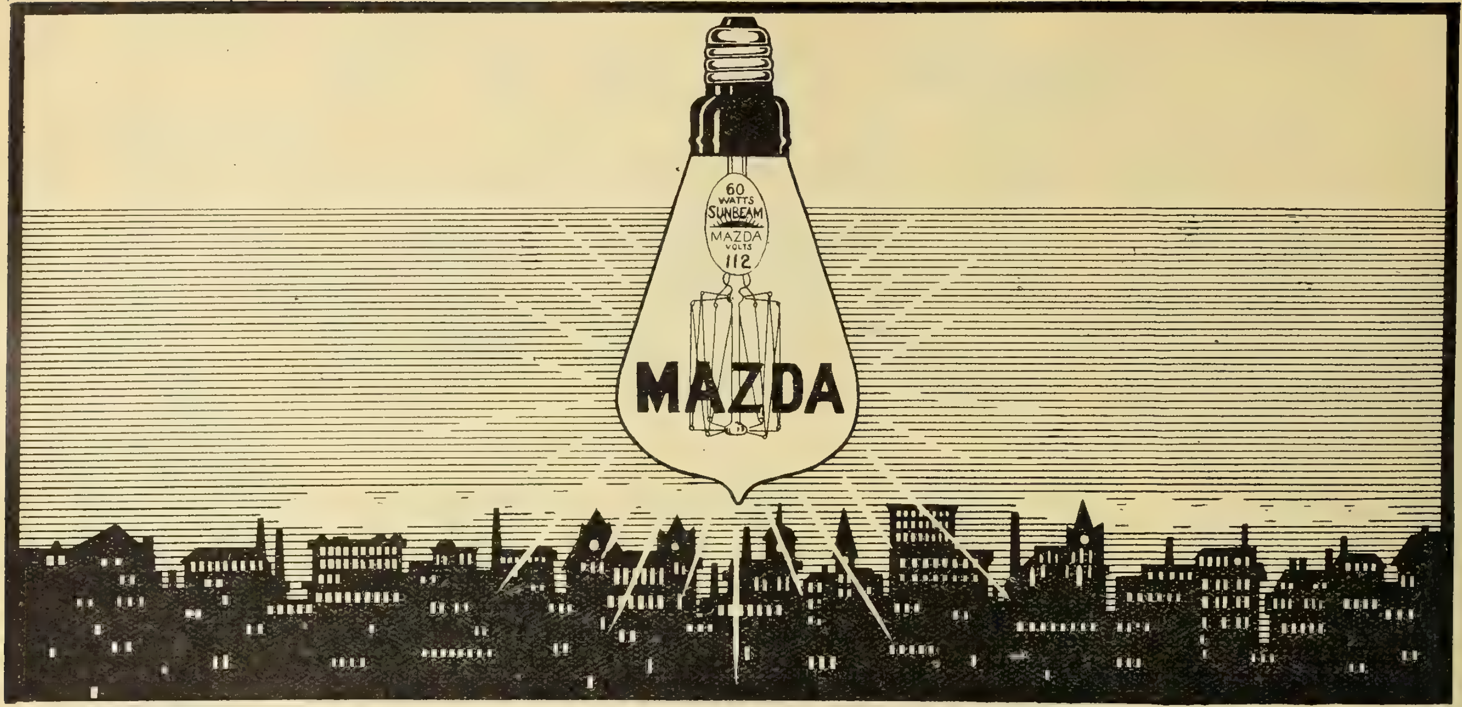
Write for Catalog No. 4



Electrical Fittings Co., Limited

70 King St. West, Toronto, Canada

Munderloh & Co., Ltd., Montreal **John Starr Son & Co., Halifax, N. S.**



Lamp Supply

The Lamp supply in every city and town is a large and important item in the business of every central station and supply house. The popular demand is steadily growing for

MAZDA SUNBEAM LAMPS

Carry a complete stock of these Lamps in all their various sizes and styles, and increased business will be the inevitable result.

Carried in stock by all dealers or write us for prices and literature.

Made in Canada by

Canadian Sunbeam Lamp Co., Ltd.

Main Office and Factory: TORONTO

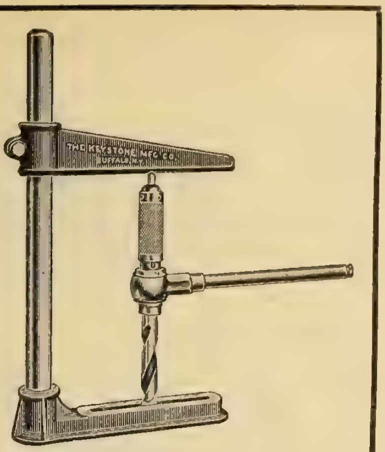
Branch Warehouses: MONTREAL WINNIPEG CALGARY VANCOUVER

"KEYSTONE"
Drilling Post or
"Old Man"

For use with
Ratchet.

Saves many hours
valuable time

The
Keystone Mfg. Co.
42 Chandler St. Buffalo, N.Y.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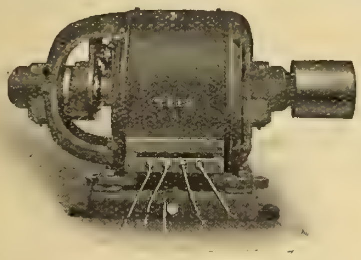

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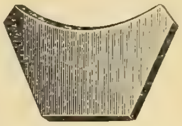
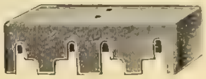

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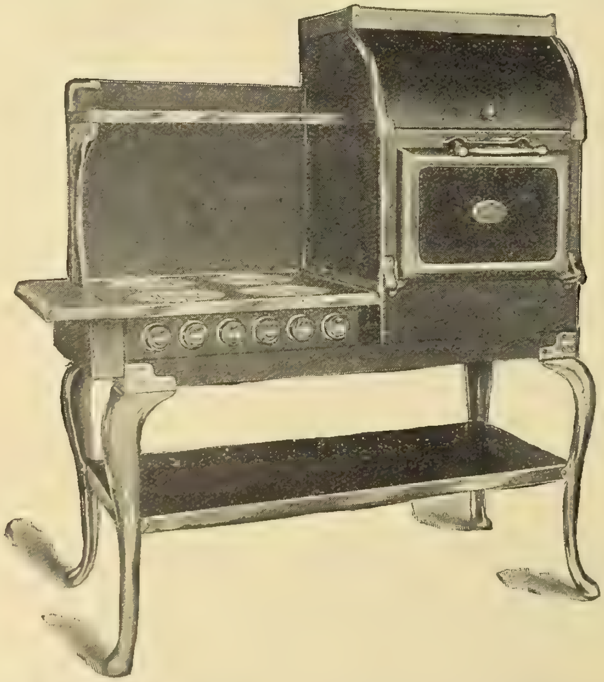

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The 1913 models are now ready and contain many valuable improvements, including our new and perfected heating units.

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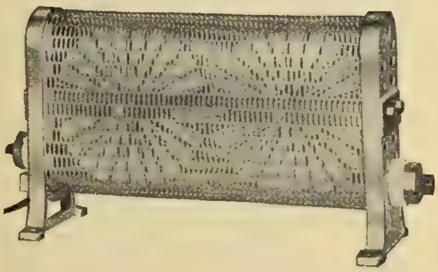
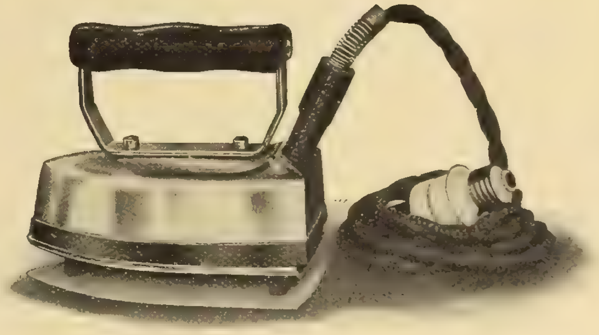


Royce Patent "Economic" Electric Radiators

Made by

ROYCE & CO.

THE "Economic" line of electric heating devices is a most profitable line to handle. They bring a good profit to the dealer or central station and are practically indestructible. The "Economic" heating element will carry a 100% overload without burning out—if operated on rated voltage it should never burn out.



Royce Patent "Economic" Electric Iron

In addition to the iron and radiator illustrated here, the "Economic" line includes Disc Stoves, Water Urn Heaters, Tailors' Irons, Car Heaters, etc. *Send for prices and particulars.*

The *Ferranti Electrical Co. of Canada, Ltd.*
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Sturtevant
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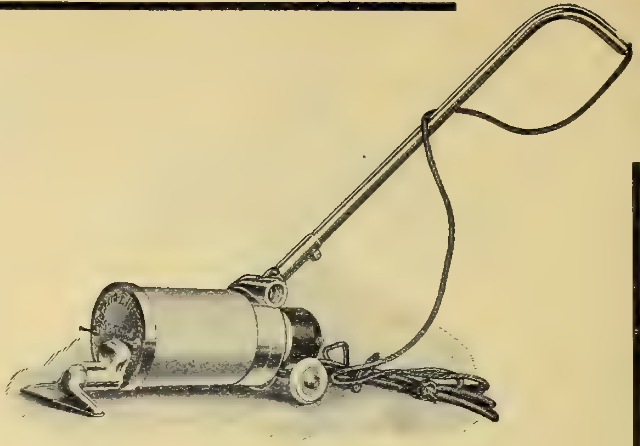
Vacuum Cleaners



Two qualities distinguish a good vacuum—**volume of air and evenness of suction.**

These qualities are found in the Northern Electric Sturtevant vacuum cleaner.

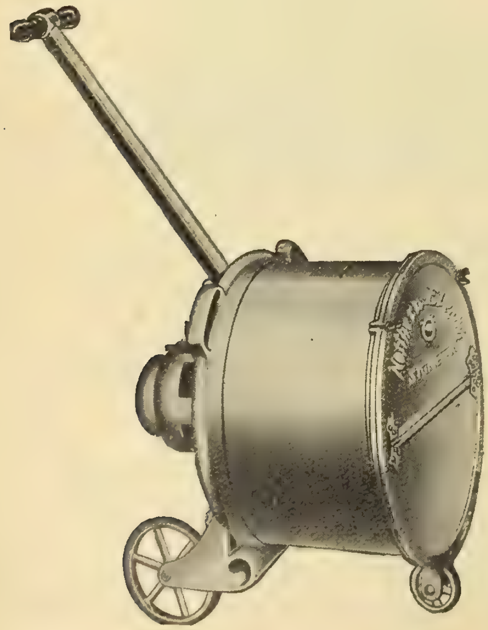
The suction in this vacuum cleaner is produced by a fan. This is the principle employed to produce a vacuum for high power purposes. A fan that revolves at a high rate of speed creates a strong, even current of air. It does its work more thoroughly than a pump machine.

A revolving fan causes no wear or tear on the machine. A Northern Electric Sturtevant vacuum cleaner will not leak nor wear out easily. Durability is one of its strongest recommendations.

The fan in this cleaner is operated by a reliable electric motor.

This combination makes a machine of the highest efficiency obtainable.

Illustrated descriptive literature that fully describes these vacuum cleaners will be sent you on request. Write our nearest house.



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Manufacturer and Distributor of Telephone and Fire Alarm Apparatus and Electrical Supplies for every possible need

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Efficiency in Semi-Indirect Lighting

depends very largely on the glassware. If the ***glass*** is right the ***light*** will be right in most cases. That's why

Delica White Glass

is the proper material for semi-indirect bowls. There are no imperfections in this pure white glass. All shadows are absolutely eliminated. And its diffusing properties are remarkable.

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Thordarson's New Improved Sign Lighting Transformers Have Arrived!

The Perfect Transformer

Unequalled For Efficiency

A rare combination of long experience, exact knowledge of service conditions and expert construction, has evolved the Thordarson New Model Sign Lighting Transformer—the Smallest in size—Lowest in cost—and Lightest in weight—but a Giant in efficiency.

In your own interest write for details and special discount.

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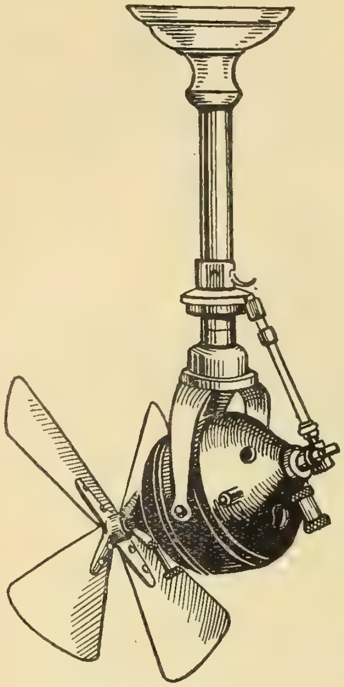

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C & W oscillating fans are the neatest and most perfect on the market.

C & W Self Rotating ceiling fans are much superior to anything heretofore offered.

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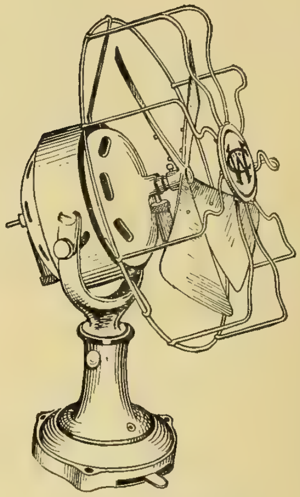

DESK FAN
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CHAPMAN & WALKER, Limited

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VANCOUVER WINNIPEG MONTREAL

Protection from Lightning Troubles

The following list of users of the Mosciki System of Lightning Protection speaks for itself:

- Victoria Falls and Transval Power Co.
- Shanghai Municipality.
- Melbourne Electric Supply Co.
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- St. John Del. Key Co., Brazil.
- Societa Dergano.
- Sociedad Espanola, Madrid.
- Societa Electrica Suburbana, Milan. &c.

(MOSCIKI SYSTEM)

Lightning, if unchecked, will break the windings of your apparatus, blow out your fuses and break down your transformers.

In short, lack of adequate and capable lightning protection may mean to you serious loss of time, money, and perhaps lives.

A host of so-called lightning arresters are on the market, but 99 per cent. of them are valueless because the principle on which they are constructed is wrong.

High frequency—not high voltage—is the cause of the damage done by lightning.

Most protective systems work on the principle that high voltage is the cause of the damage. This is incorrect, hence their uselessness.

A lightning protection apparatus to be of any use **must offer a clear path to earth for high frequency currents independent of voltage.**

The MOSCIKI System of Lightning Protection fulfills this condition absolutely—it's principle is correct—its design the best and its guarantee absolute. Write us for fuller particulars.

Mosciki Lightning Arrester

Exclusive Canadian Agents

CHAPMAN & WALKER, ELECTRICAL ENGINEERS AND CONTRACTORS

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Use

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for all kinds of

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The Jefferson Glass Company
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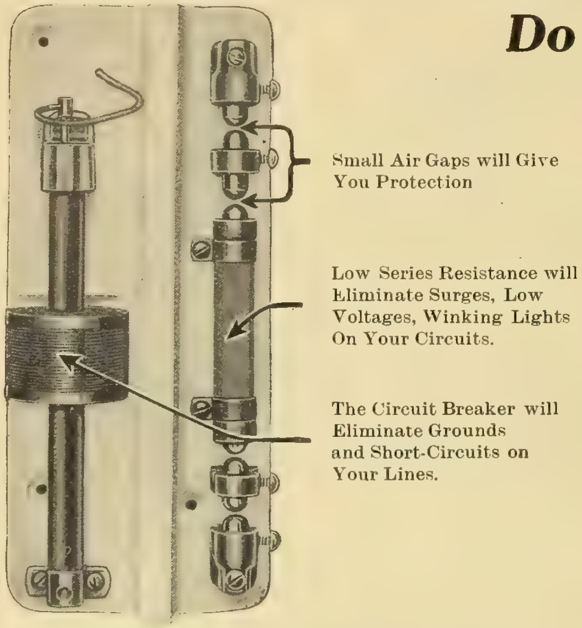
MADE IN CANADA

TORONTO CANADA

If You Want "Complete" Lightning Protection, Then You Must Demand Arresters That Do These Three Things


Small Air Gaps will Give You Protection
Low Series Resistance will Eliminate Surges, Low Voltages, Winking Lights On Your Circuits.
The Circuit Breaker will Eliminate Grounds and Short-Circuits on Your Lines.

For a lightning arrester to protect your apparatus, it must have small air gap distance that will arc over and discharge voltages but slightly higher than normal.

For one to eliminate voltage disturbances at the time it discharges, it must have a series resistance just high enough to hold back the flow of line current following the discharge to ground to a moderate value—about ten amperes.

And for an arrester to eliminate lightning arrester grounds and short-circuits, it must have a positive means for cutting off this flow of line current to ground. Can anything be more positive than the mechanical circuit breaker used on the Garton-Daniels?

If you want "Complete" Lightning protection—then you must use the only "Complete" Lightning Arrester made—the Garton-Daniels; the only arrester *combining* small air gap distances, a low series resistance and a positive mechanical circuit breaker.

Do not delay on this vitally important matter. Get and install Garton-Daniels Lightning Arresters, now. Every A. C. arrester will be sold you under a year's unconditional guarantee.

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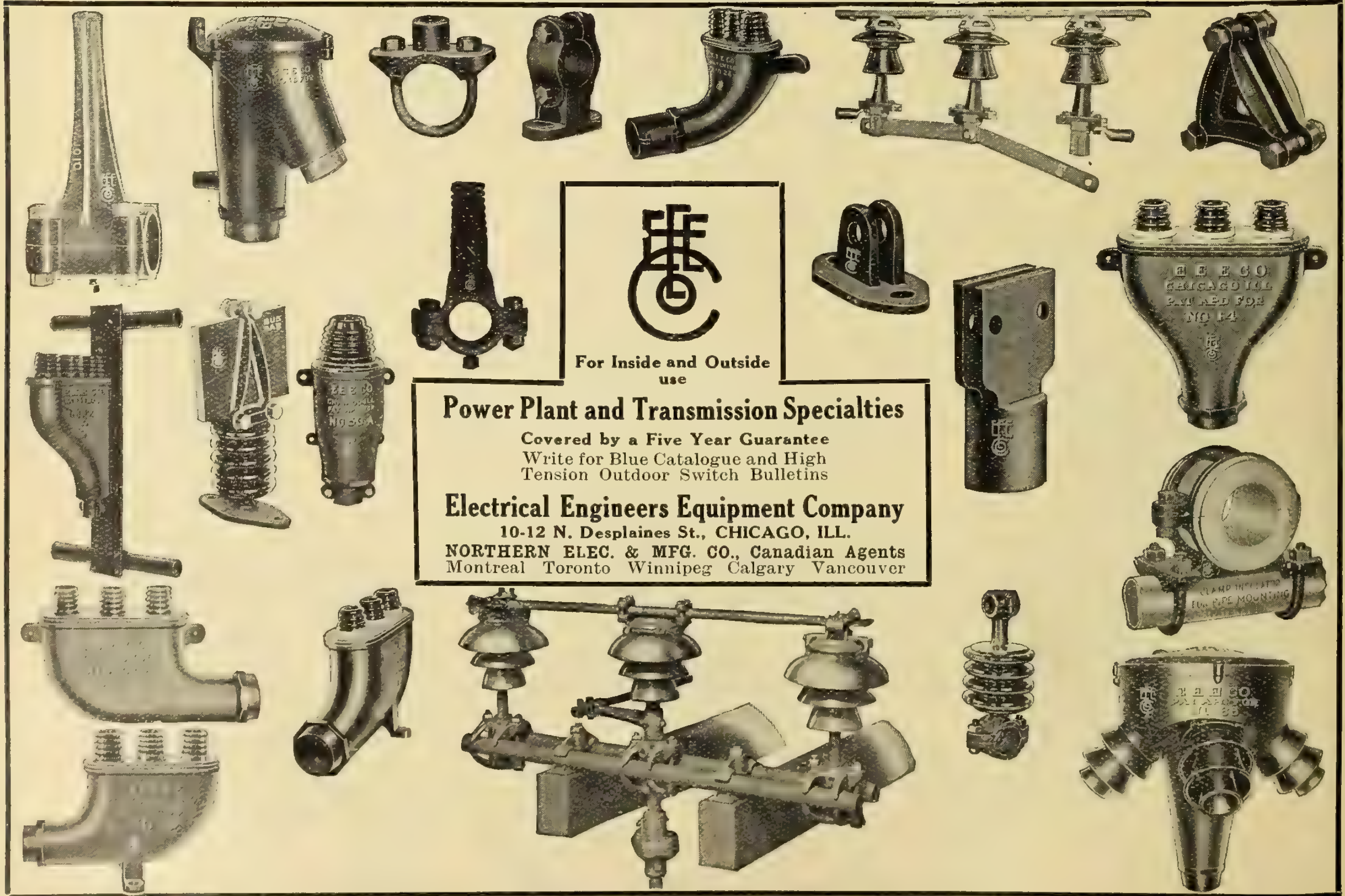
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Electrical News
Generation, Transmission and Application of Electricity

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HUGH C. MacLEAN, Winnipeg, President.
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HEAD OFFICE - - 220 King Street West, TORONTO
Telephone Main 2362

MONTREAL - Telephone Main 2299 - 119 Board of Trade
WINNIPEG - Telephone Garry 856 - 404 Travellers' Bldg.
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Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Vol. 22 Toronto, April 15, 1913 No. 8

Toronto Hydro issues Good Report

The Toronto Hydro-electric Light & Power Commission have just issued the second annual report of the operations of Toronto's electric distribution system. As expected from the rapid expansion of the system during the last six months a neat surplus is now being shown over all expenditures and the indications are that the year 1913 will show still more satisfactory results. Conservative estimates compiled from present business receipts place the 1913 surplus at well over $100,000.

It will be remembered that the total amount set aside for this system is now $4,500,000. Of this amount $3,734,911 has been expended to date, leaving a balance of $765,089, which, the report states, will be ample to complete the work for which the original sum was voted. The gross income for the year ending December 31st, 1912, is $726,763.55. Of this amount the cost of electric current and the expenses of operation and management, including repairs and maintenance, absorbed $500,564.26; the interest charged against current operations for the year, the sinking fund instalments for the year, and provision for the depreciation reserve fund absorbed $212,643.88. There is therefore left, as net surplus earnings, the sum of $13,555.41.

In the early stages of the history of the Toronto Hydro-electric Commission while the work of construction was under way, the plan was naturally followed of charging the interest on capital account against capital. During the first nine months of 1912, the business had developed to such an extent that the policy was adopted of charging only half this interest to capital account the other half being charged against expense account. During the last three months of the year we understand, however, that all this interest as well as every other legitimate expense was charged against earnings and that during this period the income was more than sufficient to meet the total demands made upon it. We understand further that during the first three months of 1913, the earnings have so far exceeded the requirements of operating expenses, new business getting, depreciation, interest on capital account and sinking fund as to leave a surplus which promises net profits for the present year as mentioned above. The net earnings for the year are being applied towards wiping off sinking fund instalments which have been accumulating for the past year and one half, and which now amount to approximately $51,000. The amount of that obligation now carried forward is $37,430, which will easily be cared for during the present year.

The success of the Toronto Hydro-electric System has evidently been satisfactory beyond the hopes of the commissioners themselves and it goes to show that competition is one of the least evils with which industries have to contend in the development of a new country. Without in any apparent way injuring the private company with which the municipality is in competition, the rates of light and power to the average citizen of Toronto have been so reduced that development along electrical lines has far exceeded anything previously experienced in the history of the city.

It is well worthy of note that the auditors employed by the city of Toronto, Jno. Mackay & Company, have a continental record of wide experience and sound judgment in connection with large financial enterprises. Their statement is that no expenditure has been charged to capital account except such as is properly attributable thereto and that in their opinion the annexed revenue account and balance sheet are properly drawn up to exhibit a true and correct view of the state of the affairs of the enterprise. The report appears in full at another place in this issue.

Electric Heating and Cooking

The British Columbia Electric Railway Company, Victoria, B.C., working in conjunction with the various electrical stores, have devoted considerable energy during the past two years towards popularizing the use of the electric range, and the results obtained go to show considerable success. Some 300 installations are now in use including two apartment houses and one electric grill. A rate of 5 cents per kw.h. net is extended to this class of business, which to the ordinary residence with four of a family brings in an average bill of $6.00 per month.

Demonstrations of cookery have been carried out in the early summer months, the equipment being moved around to the prominent corner grocery stores where baking, etc., has been done and refreshments served, and on certain days a full course dinner prepared; these actual tests have gone a long way towards satisfying the housewife of the possibilities of electric cookery. The domestic science rooms of some of the schools have been electrically equipped with ranges, disc stoves, etc., and the younger generation are not slow to realize the advantages offered by a service which now plays such an important factor in many homes.

The heating of offices in Victoria by electricity has also steadily increased. Although the cost is somewhat higher than heating by other means yet the fact of its being clean and hygenic appeals to many, particularly to the larger butcher establishments for their offices.

Electric Trucks for Calgary

As indicating the progress of electric trucks in the West, the city of Calgary has just placed an order for seven electric trucks to be used in various capacities in their municipal operations. The following extract from the report of the light and power commissioners shows that it was only after the most careful considerations and comparative tests, that electric trucks were chosen as the most suitable for the work to be done. The report is in part as follows:

"In arriving at our decision to recommend the purchase of these trucks, we have received tenders from twenty-six different companies, representing practically all the manufacturers of this class of apparatus, and we have had our engineers carefully tabulate all the tenders, guarantees and the amounts of fixed and operating charges of the various makes of gasoline and electric trucks. After the completion of this work by our own engineers, we consulted with experts and the results of the combined opinion has favored the adoption of motor trucks over our present method of transportation, and has favored the selection of electric trucks.

In our engineer's estimates the operating costs have been based, as you will note, from the tabulation sheet, upon the use of gasoline at thirty-five cents per gallon and electric current at three cents per kw.h. The results based on these figures greatly favor the electric trucks. As a matter of fact however, the current for the charging of the electric batteries will be taken at off peak load hours, when the cost will be nominal, not exceeding one cent per kw.h.

Your Commissioners would therefore recommend first, the adoption of electric trucks for the purpose mentioned, and second, the acceptance of the tender of the General Supplies Limited, as follows.

2-5 ton street sprinklers, each $5,575	$11,150
2-3 ton trucks, each $4,100	8,200
2-1 ton trucks, each $3,050	6,100
1-5 ton tractor truck, $5,050	5,050
Total	$30,500

The tender of the General Supplies was the lowest received for this apparatus. The trucks they have tendered on, are manufactured by the General Motor Company of Detroit, and Pontiac, Mich."

24,000 h. p. at Jordon River

With the recent letting of a contract for a considerable quantity of machinery for the Jordon River power plant, of the Vancouver Island Power Company, a subsidiary concern of the B.C. Electric Railway Company, Vancouver, the additional power which will be generated at the plant will soon be available. The extent of the improvements to the plant may be judged from the fact that, when completed early next Fall, the company will have expended about $650,000 in excess of the amount first appropriated for the construction of the plant which, it was thought, would be ample to meet all requirements of Victoria and district, for several years. But with the increase in the demand for power for lighting and power purposes, together with the growth of the local tramway system, the B.C. Electric Company has been forced to spend an enormous amount in addition to the power output not only at Jordon River, but also by the construction of its Brentwood Bay plant, an addition to its city steam plant on Store street, and the erection of a sub-station for distribution purposes on Richmond road. This last mentioned plant will be commenced during April, and will cost approximately $75,000.

With the Jordon River plant now running to its capacity of 12,000 horse-power, the work of adding to the plant to permit of the installation of another 12,000 horse-power is being rapidly pushed ahead, the scheme of improvements providing for the installation of other units, over and above those which will be immediately installed and the ultimate capacity will be brought up to between 36,000 and 40,000 horse-power. New reservoirs for storage purposes have recently been constructed, new flumes and other similar works have been installed, and the buildings almost doubled in capacity. A contract has been let to the John McDougall Caledonian Iron Works, of Montreal, for a water wheel of 14,000 horse-power, and later, when the full capacity of the plant is required another such wheel will be installed.

Work on the erection of the line by which the B.C. Electric Railway Company will supply residents of a portion of the Saanich Peninsula, Vancouver Island, with light and power, will be completed early in May, and by the end of the month the up-to-date facilities enjoyed by the residents and business men of Victoria will be available to dwellers in the rural districts. The main feed line will follow the route of the company's suburban tramway line and branches will be run to the various points where the demand for lighting or power facilities are sufficient to warrant the construction.

Construction work on the suburban line in the Saanich district is proceeding rapidly, a steam shovel and a large gang of men being engaged. It is expected that early in May the first regular service will be inaugurated from the city as far, at least, as Todd Inlet. The rolling stock for the new line is gradually arriving.

The transmission line running from the Brentwood Bay plant around the south end of Saanich Arm and up the west shore to the new cement plant at Bamberton Bay, has been completed.

Medicine Hat

City Electrician Brazil reports that inside electrical work in this town is greatly rushed and that during the last three months applications for electric connections resemble a boom. The electric plant which was only installed in September, 1911, is already over-loaded. The equipment consists of two Crosley gas engines, vertical type, four cylinder, direct-connected to two Bergmann generators of 175 kv.a. capacity each. The engines are rated at 250 h.p. Originally there was some difficulty in synchronizing these two machines, but this difficulty has been overcome and at present the plant is operating with entire satisfaction under the management of Mr. G. R. Taylor, plant superintendent. Anticipating a greatly increased demand for power in the very near future, the city is installing a new plant of 750 kw. capacity. These are steam turbine plants, gas being used for fuel. It is expected that this unit will be operated about the last of May.

Already about 1100 h.p. in contracts has been signed up with the various industries throughout the city for delivery as soon as the new plant is in operation.

Sussex, N. B.

The town of Sussex, N.B., has just completed the installation of a new street lighting system. The supply of power for Sussex is obtained from the Sussex Manufacturing Company, dealers in lumber, refrigerators, farm machinery, etc., and the installation of the street lighting system was made by Mr. C. T. Nisbet, electrician for the company. Prior to the installation of the new system, the town was lighted with 32 candle power carbon lamps installed on the multiple system. Now, 100-watt series tungsten lamps are in use with the result that Sussex is one of the best lighted towns in the Maritime Provinces. The circuit is controlled by a constant current regulator, Canadian Westinghouse type, and of ample capacity to fill the requirements of the town for years to come. Two generators of 40 and 60 kw. capacity respectively, driven by 75 and 125 h.p. engines, supply the energy. The company have a franchise for commercial lighting in the town of Sussex and report very satisfactory increases in the use of electric current. The general manager of the company is Mr. W. N. Robinson; president, Mr. S. H. White; electrician, Mr. C. T. Nisbet.

April 15, 1913

Montreal Electrical Society

In the absence of Mr. P. T. Davies, the president, Mr. T. R. Campbell was in the chair at the first annual dinner of the Montreal Electrical Society, held at the Edinburgh Cafe. The attendance was excellent, and the members spent a particularly pleasant evening, brief speeches being alternated with a musical programme. The toast list was short, the first being proposed by Mr. W. B. Johnson to "The Volts," who were the victors in a membership contest. This ended in an addition of 204 members, and, said Mr. Johnson, was an illustration of the value of co-operation. Mr. T. E. Salter replied, and proposed "The Amperes," to which the chairman replied.

The formation of the society was due to the efforts of Messrs. W. H. Tees, the treasurer, and J. C. Bray, the secretary, and the chairman eulogised the work done by these gentlemen, who, replying, spoke of the growth of the Society. Mr. Tees, with whom the idea started, said that the Society had expanded, and now embraced all branches of the electrical industry. The other speakers included Messrs. U. A. Leduc, T. N. White, J. D. Lachapelle, W. H. Winter, and W. H. Turner, the main topic being the value of such an organization, both for technical and social purposes, and the room for further growth.

Pittsburgh Meeting A.I.E.E.

A regular meeting of the American Institute of Electrical Engineers will be held in Pittsburgh, Friday and Saturday, April 18th and 19th, 1913. This meeting will be held under the auspices of the Committee on the Use of Electricity in Mines, of which Mr. Geo. R. Wood, consulting engineer of the Berwind White Coal Mining Company, is chairman. The program includes the following papers: (1) Purchased Power in Coal Mines; (2) Central Station Power for Mines; (3) Safe-guarding the Use of Electricity in Mines; (4) Electricity as Applied to Mining; (5) Central Station Power for Coal Mines; (6) Alternating Current Motors for the Economic Operation of Mine Fans; (7) Characteristics of Sub-station Loads at the Anthracite Collieries of the Delaware and Lackawanna Railroad Company; (8) Mining Load for Central Stations.

The subject of electricity in mines has assumed such proportions in the last year or so as to justify a special meeting given over to the discussion of its various phases. Not only are mining people themselves interested, but central station operating companies and manufacturers of electrical apparatus for mines as well.

The Canadian Westinghouse Report

The ninth annual report of the Canadian Westinghouse Company, Limited, shows that the net profits for the year ending December 31st, 1912, were $1,050,123. This compares with $1,010,153 for the previous year, so that although the 1911 record was 45 per cent in excess of the previous high point of the company, the 1912 business is still greater. The assets of the company now amount to $7,843,624 accounted for mainly by a capital stock issue of $4,709,112, a profit and loss account of $1,302,599, depreciation account of $500,000, and inventory adjustment and insurance fund accounts of $100,000 each. The directors of the company are George Westinghouse, president; H. H. Westinghouse, vice-president; L. A. Osborne, vice-president; Paul J. Myler, vice-president and treasurer; T. Ahearn, Sir. Jno. Gibson, J. F. Miller, Warren Y. Soper, C. F. Sise, C. A. Terry, G. E. Tripp; F. A. Merrick is general manager; Jno. H. Kerr, secretary, and N. S. Braden, manager of sales.

Growth of the City of Calgary

City Electrician Outlines Past Year's Progress—Much Valuable Information and Cost Data

The growth of the city of Calgary is well exemplified in the report of city electrician R. A. Brown covering the operations in his department for the year 1912. The report is extracted herewith. Particular interest attaches to Mr. Brown's figures of cost on extension work carried out during the year, his remarks with reference to organization, his outline of the distribution system in Calgary and his data for underground work. It would also appear that the city of Calgary is fortunately situated in its relations to the Calgary Power Company which will soon be in a position to deliver well up to 30,000 h.p. This company is just completing a second pole line with which they hope to guarantee continuity of service.

General

The year has been one of steady growth for all branches of the department. The records show that on December 31st, 1912, we were supplying electricity for light and power to 10,220, of which 4,806 were connected during the year 1912. Following is a statement of the receipts, expenditures and surplus of the department for the past six years

Year		$	Surplus
1906	Revenue	23,166.98	
	Expenditure	16,518.20	$ 6,648.78
1907	Revenue	58,172.67	
	Expenditure	35,878.37	22,294.30
1908	Revenue	85,560.65	
	Expenditure	58,777.70	26,782.95
1909	Revenue	116,668.36	
	Expenditure	111,484.84	5,183.52
1910	Revenue	193,099.82	
	Expenditure	170,692.50	22,407.32
1911	Revenue	206,227.95	
	Expenditure	202,247.48	3,980.47
1912	Revenue	384,173.32	
	Expenditure	366,382.41	17,790.91

Revenue figures are exclusive of revenue from the street railway department, which in 1912 amounted to $105,091.40.

Rates

The city plant began operations in December, 1905, with a lighting rate of 14c per kw. hour and power rate of 10c per kw. hour. By-laws have since been passed reducing rates as follows:—August, 1908, light 12c, power 7c; April, 1909, light 11c, power 6c; May, 1911, light 9c, power 1 to 2c depending on amount consumed; this reduction was made when the department was first supplied with hydro-electric power; August, 1912, light 7½c.

Following is a detailed statement of receipts and expenditures for the past year.

Receipts

Meter light		$237,635.28	
Meter power	$164,781.98		
Less St. Ry. power .	105,091.40	59,690.58	
Flat rate light		32,353.91	
Flat rate power		3,910.50	
Street light		50,455.80	
Re-connections		127.25	$384,173.32

Expenditures

Overhead lines		
Labour	$ 601.46	
Material	8,292.83	$ 8,894.29
New services		
Labour	4,367.83	
Material	7,139.54	11,507.37

April 15, 1913

House connections		
Labour	16,029.18	
Material	4,475.31	20,504.49
Power connections		
Labour	3,496.81	
Material	136.75	3,633.56
Meter a.c. power		
Labour	40.73	
Material	749.50	790.23
Meter a.c. lighting		
Labour	736.04	
Material	7,321.51	8,057.55
Repairs to meters		
Labour	1,455.32	
Material	4,857.97	6,313.29
Arc lamps		
Labour	6,973.90	
Material	16,275.53	23,249.43
Tungstens		
Labour	477.95	
Material	2,456.00	2,933.95
Incandescent street lighting		
Material	265.27	265.27
Underground construction		
Labour	33.80	33.80
Underground conductors		
Labour	17.70	17.70
Office expenses		
Labour	13,678.87	
Material	7,054.78	20,733.65
Sub-station equipment		
Labour	77.40	
Material	310.94	388.34
Sub-stations		
Material	67.24	67.24
Engineering and superintendence		
Labour		
Material	3,506.43	3,506.43
General expenses		1,581.00
Purchased power		119,550.96
Contingency		1,049.00
Insurance		164.05
Bank interest		7,410.70
Debenture interest		21,350.73
Sinking fund		8,453.87
Depreciation		18,552.05
Loss on debentures		3,466.76
Debit to power department		67,119.99
Meter fund account	$9,600.00	
Less expended	6,313.29	3,286.71
Purchase of land		3,500.00
Credit balance—1912		17,790.91
		$384,173.32
Expended from depreciation account—1912		$ 50,387.20

Organization

The first work undertaken in 1912, was that of re-organizing. Officers were put in charge of each important branch of the department, who are held entirely responsible for the proper carrying out of all work coming under their jurisdiction. A Clerk of Works was appointed whose duty it is to keep a record of all time and material on each job, and file a copy of the same in the office, where it is always available for reference.

Distribution Record System—Plans were made of the distributing system, showing all primary lines and location of transformers. All transformers in service have been tested. A filing record system has been installed wherein is kept all data concerning the load and general characteristics of each transformer, as also a plan of the secondary circuit to which the transformer is connected.

Meter Filing—A meter filing record card system has also been installed wherein is kept the meter location, a curve showing its accuracy, when last tested also the capacity, reading and date meter was set and first put into service.

Service.—The light and power service throughout the year has by no means been satisfactory, for, while we have been successful in arranging the lines and equipment of our distribution system, so as to give uniform voltage to practically all customers to within the allowed limits of 3½ to 4 per cent., still, the numerous interruptions and unstable voltage of the service has been the cause of great inconveniences to our customers. Everything possible is being done to correct both of these conditions. In fact the latter condition has already been remedied on the greater part of the system, by the improved voltage regulations of the Calgary Power Company supply, and the installing of automatic feeder regulators on all important lighting circuits; these regulators are set to give the desired voltage at the center of distribution and are checked by recording meters at regular intervals, when any variations from normal are noted and corrected. Every precaution is now being taken both by the Calgary Power Company and ourselves to safeguard and better the service. To this end our auxiliary plant is kept under steam at all times, ready to take up at a moment's notice the most important part of our lighting and power load.

12,000 Volt System

This consists of 8¼ miles of overhead 3-phase, No. 00 bare copper wire; 23,635 ft. of No. 00 12,000 volt, three-phase, paper insulated, lead covered underground cable; 338 forty-five foot poles, and the necessary cross-arms, insulators, etc. The overhead lines inter-connect the Calgary Power Company's sub-station in East Calgary with the city sub-station at Ogden, through a one-circuit line, and also connect the Power Company's sub-station with the city's generating station in Victoria Park, through two separate three-phase lines. The underground cable of this system inter-connects the generating station and the new sub-station on Ninth ave. and Seventh street west, through two separate three-phase cables; each cable being of sufficient capacity to supply the maximum power required for the station, so that in case of trouble on either cable, the other is capable of carrying the load while repairs are being carried out.

2300 Volt Distribution

The current is distributed throughout the city, over twelve 2,300 volt, three-phase circuits ranging in size from No. 0 to 300,000 circular mils. Underground feeder cables are used to supply the current to the centre of distribution of the most important lighting circuits, with the object of making the source of supply as reliable as possible. The 2300 volt system consists of 198.93 miles of pole line, containing 10,348 poles, 294,671½ pounds of copper wire, 16,348 ft. of 2300 volt, three-conductor, lead-covered cable, and 1036 service transformers, ranging in capacity from .6 of a kw. to 100 kw. and having an aggregate capacity of 8,865.6 kv.a. There are 696 transformers with an aggregate capacity of 4,181.6 kv. used for lighting and small motor service, and 340 transformers with a normal rating of 4,684 kv.a. in use for power purposes only.

The approximate yearly core and copper losses of the service transformers is 1,260,000 kw.h. Taking current at 1½c per kw.h. this is equivalent to $18,900 per year.

Secondary Distribution

From the transformers the current is distributed to the customers over secondary feeders, which are mostly single phase, three-wire, 110 and 220 volts for lighting, and three-phase, 220 volts for power. There are 273,437½ pounds of copper wire in service for secondary distribution, and 90,343½ pounds for service leads.

The department has in service 10,106 meters, ranging in capacity from 5 to 200 amperes. The combined shunt losses of all meters equals 205,000 kw.h. With current at 1½ cents per kw.h. this is equivalent to $3,075 per year.

Street Lighting

The street lighting consists of 1,100 lights, of which 600 are magnetite arcs, 260 enclosed arcs, and 240 250-watt, 6.6 amp. tungstens. The lights are placed approximately 566 feet apart on avenues, and 346 ft. on streets. They are fed and controlled by nineteen separate circuits, and light 201 miles of the city's streets and avenues.

The ornamental or intensive street lighting which is to be installed in certain sections of our most important business streets is a matter which is now in line for very careful consideration. In the first place, a by-law was passed providing for the installing of five-light ornamental standards, equipped with five 100-watt tungsten lamps on all streets covered by the by-law except Eighth ave., where it was provided to use inverted magnetite arcs, with opal globes on ornamental brackets attached to the iron trolley poles. Since the passing of the by-law a large number of magnetite arcs for Eighth avenue have been put into service, and, three blocks of the ornamental standard lighting for Ninth Avenue have been completed. The placing of these lights in service has given an opportunity for all citizens interested to judge as to the merits of the two systems of lighting; it seems to be the concensus of opinion that the Eighth avenue lighting is superior in every respect to that of Ninth avenue. In view of this and the expressed opinion of Commissioner Graves from his personal observation and comparison of the two lighting systems in vogue in the Old Country, and all the principal cities of the East, it is the firm conviction of this department that if it is legally possible, the by-law covering the intensive lighting system should be amended and provision made for the installation of the Magnetite arc system on all the streets and avenues (with the exception of Ninth avenue) enumerated in the by-law.

Sub-Stations

Two sub-stations were constructed and equipped in 1912 one located at Ogden near the entrance of the C. P. R. shops and the other at Seventh street west and Ninth avenue. The Ogden sub-station has a transformer capacity of 3,000 kw. The equipment when installed complete will consist of six 500 kw., 12,000 volt, single phase, step-down transformers; one 500 and one 300 kw. motor-generator set and one arc light regulator, together with necessary switching equipment and control apparatus.

The Ninth avenue and Seventh street west sub-stations have a transforming capacity of 6,000 kv.a. and d.c. generating capacity of 2,000 kw. The equipment when completed will consist of two 3,000 kv.a., three-phase, 12,000 volt transformers, two 1,000 kw. motor-generator sets, six arc light regulators and the necessary automatic voltage regulators, switching equipment, etc.

Underground Conduit System

The underground conduit system consists of 14.94 trench miles of underground conduit, and 94.59 duct miles. Duct ways vary from 1 way to 24 ways,

The number and type of manholes are as follows:—oblong manholes, 80; octagonal, 227; handholes, 2; total manholes, 308; street railway outlets, 10.

Cost and Data of Conduit Construction During 1912

18-way duct.—trench feet, 2.063; duct feet, 37.134. Cost per trench ft., for labor, $.835; material, $2.383; total, $3.218. Cost per duct foot, for labor, $.054; material, $.129; total, $.183.

15-way duct:—trench feet, 483; duct feet, 7.245. Cost per trench foot, for labor, $1.007; material, $2.345; total, $3.352. Cost per duct foot, for labor, $0.065; material, $0.142; total, $0.207.

12-way duct:—trench feet, 1.857; duct feet, 22.284. Cost per trench foot for labor, $0.802; for material, $1.666; total, $2.468. Cost per duct foot for labor, $0.668; for material, $0.138; total, $0.806.

9-way duct:—trench feet, 2.454; duct feet, 22.086. Cost per trench foot for labor, $0.754; for material, $1.328; total, $2.082. Cost per duct foot for labor, $0.837; for material, $0.138; total, $0.975.

8-way duct:—trench feet, 1.624; duct feet, 12.992. Cost per trench foot for labor, $0.625; for material, $1.025; total, $1.650. Cost per duct foot for labor, $0.078; for material, $0.128; total, $0.206.

3-way duct:—trench feet, 4,095; duct feet, 12,285. Cost per trench foot for labor, $0.822; for material, $0.696; total, $1.522. Cost per duct foot for labor, $0.246; for material, $0.232; total, $0.478.

Additional Work to Previous Construction in Same Trench

6-way duct:—trench feet, 12,852; duct feet, 77,112. Cost per trench foot for labor, $0.717; for material, $1.092; total, $1.709. Cost per duct foot for labor, $0.119; for material, $0.284; total, $0.402.

Lane work only:—trench feet, 4,183; duct feet, 25,098. Cost per trench foot for labor, $0.711; for material, $1.220. Cost per duct foot for labor, $0.119; for material, $0.203; total, $0.322.

Paved lane work, complete distribution:—trench feet, 932; duct feet, 3,432. Cost per trench foot for labor, $0.496; for material, $0.883; total, $1.379. Cost per duct foot for labor, $0.134; for material, $0.241; total, $0.375.

6-way duct:—conduit and pipe total equals trench feet (unpaved work—lanes—complete distribution):—trench feet, 2.122; duct feet, 8,592. Cost per trench ft. for labor, $0.435; for material, $0.785; total, $1.220. Cost per duct ft. for labor, $0.137; for material, $0.203; total, $0.340.

Approximate amount of gravel used on the above work was 2,934 cu. yd., varying in price from $0.85 to $1.61 per yd. f.o.b. at points required.

Cost of Manhole

The approximate cost of a 6 x 7 ft. manhole figures out as follows:—

Foreman, 5 hours	$ 2.00
Carpenter, erecting and removing forms	3.60
Labor, excavating	10.80
Mixing and placing concrete	9.00
Team moving dirt and hauling gravel	6.00
Cement, 30 bags, 80c.	24.00
Gravel, 7 cu. yds., $1.25	8.75
Manhole casting	56.70
Steel rails and reinforcement for same	9.15
Total	$130.00

Power

Calgary for the past eighteen months has been receiving the bulk of its electrical energy for light and power purposes from the Calgary Power Company's hydro-electric generating plant located at Horseshoe Falls, a distance of approximately fifty-eight miles from the city. The power supplied by the company until just recently was delivered over a one-circuit transmission line, which was the cause of the majority of the numerous interruptions in the service, during the past year. The company now has its second line in operation and we feel that it will greatly improve conditions as regards continuity of service. I understand as a further precaution the company intend increasing the number of poles on that portion of their transmission line subject to very severe winds, with the hope of practically eliminating transmission line troubles; it is also the intention of the company to extend their Horseshoe Falls plant by adding to its present equipment one 6,000 h.p. hydro-electric unit and two 3,000 kw. transformers, together with the necessary switching and control apparatus. With these additions, this plant will be capable of developing approximately 18,000 horse power during the seasons of the year when water conditions will permit. It is also understood the company will immediately start work on the construction of a new generating station at Kananaskis Falls, which is to have a capacity of 10,000 horse power. It looks as though Calgary in the very near future will be receiving from the power company a thoroughly reliable power service for the twelve months of the year and to the extent of at least the minimum to be contracted for, i.e., 5,000 horse power.

It is unfortunate that the natural characteristics of the country are not favorable to the generating of electric power by means of hydro-electric development, which is due to the very low water conditions of the rivers during the winter months, when the demand for power is the greatest. However, Calgary is in a much better position to deal with its power situation than most cities of Western Canada, for it has numerous possibilities of coping with the future needs of the city for the large amount of power that will be required for domestic and street lighting, and for operating the machinery of the numerous industries which our fast growing and prosperous city will naturally attract. We are fortunate in that in our new agreement with the Calgary Power Company we will have the first call on the company's two plants up to whatever minimum the council see fit to contract for, and the company are capable of continuously delivering.

For the additional power which we shall need over and above that which the Calgary Power Company can be relied on to continuously supply, we have the following means from which it can be generated, i.e., coal or gas fired boilers, with steam turbines, or both; coal with gas producers and gas engines, and natural gas with gas engines. The coal propositions require to be considered from two points of view, namely,—the location of the plant at or near a coal mine and transmit the power electrically to the city, or the location of the power plant in the city and the using of rail delivered coal. The generating of power from natural gas must also be considered practically from the same points of view, that is, the installing of the power plant at gas wells and transmitting the power electrically or the using of piped gas to a plant located in the city.

It is evident that the task of choosing the best of the above methods of power generation for Calgary to adopt is a very complex one, and the Commissioners are to be commended on using good business judgment when they decided to secure the services of an eminent electrical expert to deal with this question; also to advise us as to the best and most economical layout for our underground system, and proper locations and layout for our sub-stations, also to advise concerning the best operating system, etc., for the department to adopt.

The laying out of a programme such as just mentioned, will put the city in the position that all moneys appropriated for electric light and power purposes will be expended on nothing but what will work into and form part of the ultimate plant to which the city of Calgary will look to for its future supply of electrical energy.

Summary of Work Carried Out By the Department During The Year 1912

82.7 miles of new line constructed.
18.2 miles of line re-constructed.
21 miles of line overhauled.
521 new transformers put into service.
198 transformers changed on account of being over or under loaded.
812 street lights installed and put into service.
3,000 kw. sub-station at Ogden constructed and equipped.
6,000 kw. sub-station at Seventh street west and Ninth avenue constructed and equipped.
6.36 miles of underground conduit installed.
4,806 new customers were connected to our lines.
4,980 h.p. in motors was added to power load.

Another Trent Plant Operating

At Dam No. 5—General Design Identical with Plant at Dam No. 2—Slightly Less Capacity

Early in the present year the second hydro-electric generating plant in the neighborhood of Trenton was placed in commission by the Sidney Electric Power Company, a subsidiary of the Electric Power Company, which operates a comprehensive system in Central Ontario. This last plant to be placed in operation is situated at what is known as Dam No. 5, at Frankford, some 5 miles north of Dam No. 2 which is close to Trenton.

A very complete description of the No. 2 equipment was published in the June, 1912, issue of the Electrical News. In as much as these two plants, at dam No. 2 and dam No. 5, are practically duplicates of one another, this article will deal only with innovations in the number 5 plant which it was found necessary to introduce on account of local conditions.

It will be recalled that at No. 2 there were installed four electrical units of 750 kw. capacity. These operate under a 20 ft. head, the speed being 120 r.p.m. On account of the distance between the two plants being only 5 miles, the variation in the flow of water is very small. The head at No. 5 however, is only 18 ft., 2 ft. less than at No. 2 and on this account it was not possible to operate generators of the same capacity. The main difference in the installed equipment however, is in the speed, which at the upper dam is 112½ revolutions (instead of 120) per minute, along with, of course, the necessary change in the number of poles of the generator. The turbines, therefore, on account of the lower head have a capacity of 1200 h.p. instead of 1400 h.p. at full load and the generators are rated at 650 kw. instead of 750

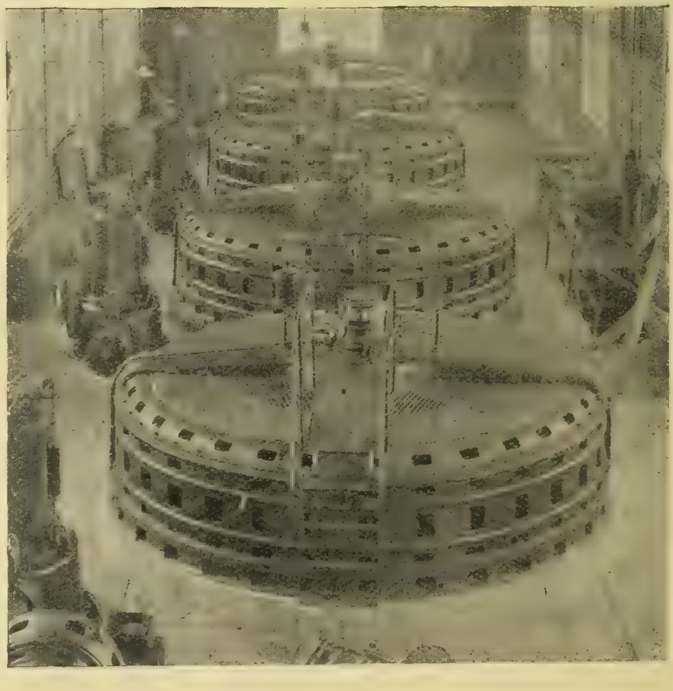


Fig. 1—Four 650 kw. units, dam No. 5, Trent Valley

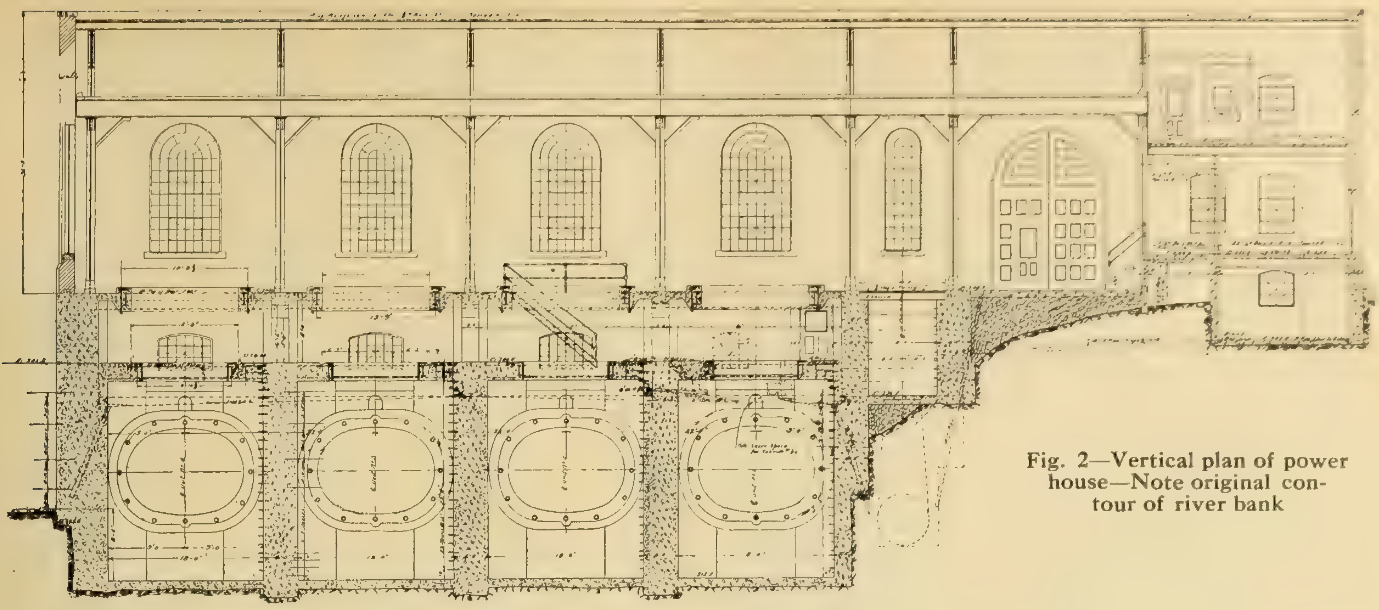


Fig. 2—Vertical plan of power house—Note original contour of river bank

kw. The turbines were again supplied by the Canadian Boving Company, and are of the double runner, vertical type. The oil pressure governors are also Boving type. The generators were, as before, supplied by the Swedish General Electric Company. They are 60-cycle, 3-phase, 7,000 volt, vertical type. There are two exciters, one turbine driven vertical type of 75 kw., 125 volt capacity and one motor generator 75 kw., 125 volt, the motor operating on 2,400 volt, 3-phase, 60-cycle current.

The main difference in the design of the power house is shown in the line sketch in Fig. 2 herewith. It will be seen that an erecting space has been left at the shore end of the power house between the switchboard platform and the exciters, into which space a railway siding runs. The switchboard is situated on a platform at the shore end of the power house 4 ft. above the main floor, thus allowing the switchboard operator a good view of the power house. The switchboard consists of black slate panels, on the back and front of which no voltage higher than 125 is exposed. The 7,000 volt oil switches are situated on frame work far enough back of the board to allow of passage between the operating board and the oil switches. The frame work supporting the latter also carries current and potential transformers, bus-bars, disconnecting switches, etc. The switchboard was furnished by the Monarch Electric Company of Montreal.

A gallery over the switchboard platform contains generator field rheostats, electrolytic lightning arresters, choke coils, line outlets, and a chief operator's office.

The basement under the switchboard platform contains motor driven air compressor and air receiver for cleansing purposes; also oil tank, pump and piping for a lubricating system for the generating bearings.

It will be noticed by reference to the lay-out of Fig. 2, which also shows the original contour of the river bank,

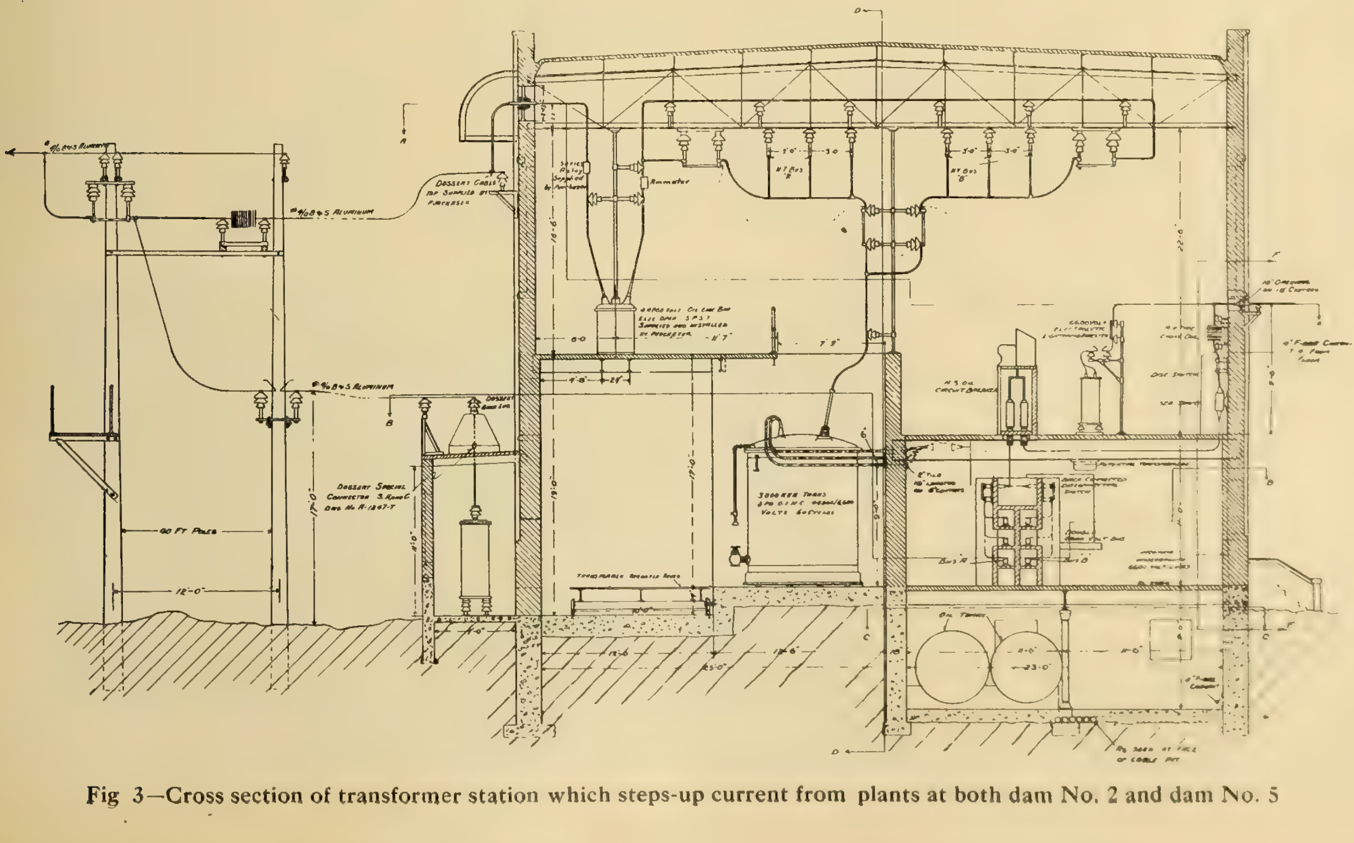


Fig 3—Cross section of transformer station which steps-up current from plants at both dam No. 2 and dam No. 5

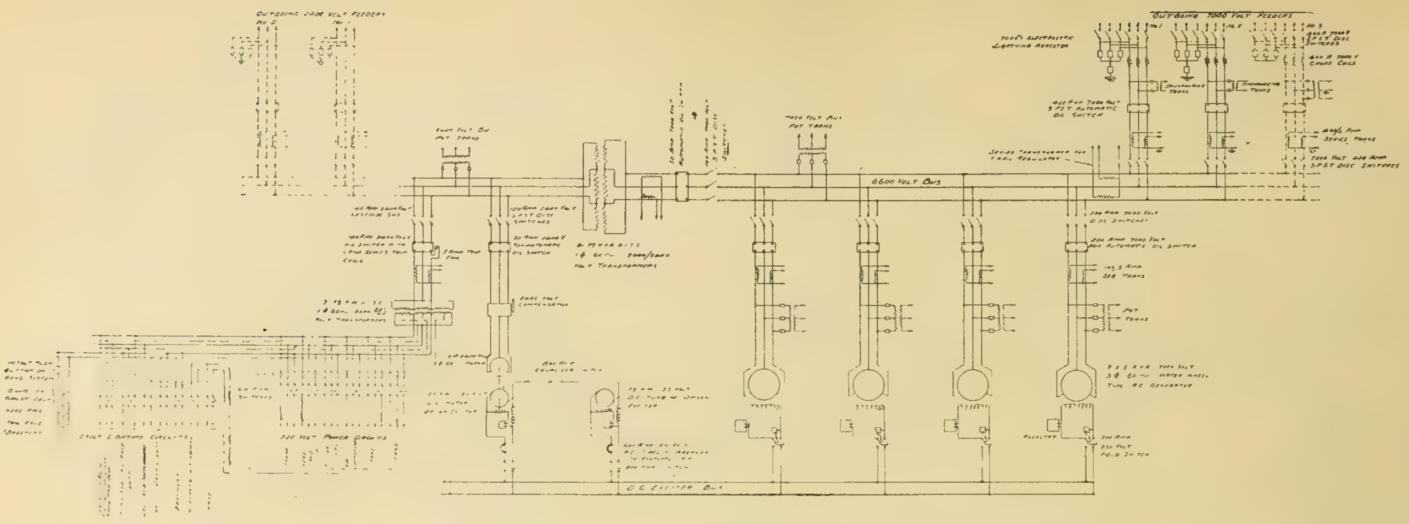

Outgoing 7000 Volt Feeders
No. 1
No. 2
No. 3
7000 V. Electrolytic Lightning Arrester
400 A. 7000 V. S.P.S.T. Disc Switches
400 A. 7000 V. Choke Coils
Synchronizing Trans.
400 Amp. 7000 Volt 3 P.S.T. Automatic Oil Switch
Series Trans.
7000 Volt 400 Amp. 3 P.S.T. Disc Switches
7000 Volt Bus Pot Trans.
Series Transformer for Tirrill Regulator
6600 Volt Bus
200 Amp. 7000 Volt Disc Switches
200 Amp. 7000 Volt Automatic Oil Switch
Ser. Trans.
D.C. Exciter Bus

Fig. 4—Wiring diagram, dam No. 5 power house, Trent Valley Canal

how judiciously the power house was designed to avoid unnecessary excavation or filling.

Four 7,000 volt out-going circuits carry the current a distance of 4 miles to dam No. 2 transforming station where it is stepped up to 44,000 volts for transmission over the system of the Electric Power Company. Our article already referred to in the June number of the Electrical News contained a minute description of this transforming station which is designed to take care of the generating capacity at both dam No. 2 and dam No. 5.

The transforming capacity in this station, a plan of which is shown herewith consists of three 3,000 kv.a., 3-phase units which step up from 7,000 to 44,000 volts. The building is 61 ft. 3 in. x 56 ft. 6 in. x 45 ft. high. The transformers have wheels provided in the base and are set on rails laid in the floor so that any unit may be easily shifted. The transformers are of Canadian Westinghouse manufacture as are also the 44,000 circuit breakers. A photograph of the interior of No. 5 generating power house is shown in Fig. 1.

Another Pioneer Gone

Mr. George P. Brophy one of the founders of the Ottawa Electric Railway and the Ottawa Electric Company, superinintendent engineer of the Ottawa river works and one of the most prominent figures in the capital died at his late residence 320 Chapel street, on Friday, April 4th,, of heart trouble, in his 65th year. With the pasing of Mr. Brophy only two of what was known in Ottawa as the "famous five" are left, namely, Thomas Ahearn and Warren Y. Soper. The other two of the quintette were the late Peter Whelen and the late J. W. McRae. None of the five however, had more to do with the once vital question of whether it was possible to run a street railway under Canadian winter conditions than Mr. Brophy. It was owing to his aggressiveness and foresight that what some engineers declared was impossible was successfully overcome.

The late Mr. Brophy was born in Carrillon, Que., in 1848, and was the second son of John B. Brophy and Jane Byrne. His education was obtained in the Ottawa schools. When a young man he accepted a position with the Department of Public Works as a draughtsman and assistant engineer in New Brunswick. After a year in that position he was appointed by the late Hon. Alexander MacKenzie, superintendent engineer of the Ottawa River Works, an office he held up to the time of his death. Besides being one of the founders and a director of the Ottawa Electric Railway Company and the Ottawa Electric Company, he was also a director of the Ottawa Gas Company, and vice-president of the Ottawa Trust and Deposit Company. He also assisted in forming the Ontario Graphite Company, the Ahearn Electric Heating and Manufacturing Company, the Locomotive and Machine Company of Montreal, the Thousand Islands Land Company, the Ontario Smelting, Milling and Refining Company and other smaller concerns. The late Mr. Brophy leaves a widow, one son and four daughters.

Saskatoon, Sask.

As indicating the amount of patronage that may be expected in a city of approximately 25,000 inhabitants, the following figures of the amount of business done every week since the railway was inaugurated on January 1st of this year are valuable. It will be noticed that in less than three months the daily average receipts have almost doubled.

Week ending	Total passengers	Daily av. cash.	Daily aver. no. of passengers
January 4	21,630	$270.35	5,407
January 11	35,626	296.90	5,938
January 18	41,476	345.65	6,913
January 25	40,776	339.80	6,796
February 1	45,320	377.60	7,552
February 8	52,304	435.85	8,717
February 15	51,179	426.50	8,530
February 22	53,015	441.25	8,835
March 1	55,042	458.70	9.174
March 8	65,490	467.80	9,356
March 15	67,428	481.60	9,632
March 22	70,083	500.60	10,112

Long distance telephone charges between England and France are being modified. The price of conservation between Paris and London will be reduced from 8s. to 4s.; between Lyons and London from 10s. to 6s. 2d.; and between Bordeaux and London from 10s. to 8s. The rate for telephoning between Marseilles and Edinburgh will remain at 12s. 6d.

The Newfoundland Government propose to extend the telegraph system around the seaboard of the island, 500 miles having been built in the past four years, with a prospect of 250 more being constructed during the present season; also to build three more wireless stations on Labrador and to establish a telephone system for St. Johns and a number of the outlying places.

Electrical Equipment in the Modern Bank

The new head office of the Bank of Toronto splendidly equipped with generating plant and all auxiliary equipment

Fig. 1

The new head office building of the Bank of Toronto, corner King and Bay streets, Toronto, is just nearing completion and, while an example of architectural beauty of the best classic type, it is at the same time one of the most modern and interesting public buildings in Canada from the point of view of its electrical equipment.

The building consists of six storeys, being four above ground with a basement and sub-basement. The sub-basement is occupied principally by the power house, switchboard and auxiliary equipments, boiler room, engines, air cooling and purifying equipment, etc. To guard against any possible contingency due to failure of power supply on the part of the local distributing company, a steam engine driven, direct current generator plant has been installed in the sub-basement to a capacity of 200 kilowatts. There are four generators in the equipment made up of two 75 units and two 25 units, each connected to its own engine; the generators were supplied by the Canadian General Electric Company; the engines are Robb manufacture.

This small isolated generating plant is one of the handsomest to be seen anywhere. The walls and floor are white enamel brick, with floor space of 1800 sq. fet. The main switchboard, some 15 ft. in length, is of 1½ in. grey Tennessee marble specially chosen for this plant. The sides and top of the switchboard are also enclosed with slabs of the same material, adding not only to the appearance of the board but greatly also to the possibilities of keeping the rear of the switchboard clean. Reproductions both of the front and rear of the switchboard are shown herewith. The switchboard which was supplied by the Northern Electric & Manufacturing Company is equipped with all the necessary instruments. To the left are two Weston volt meters. The eight ammeters shown on the main part of the board are also Weston type. At each end to the right and left of the ammeters is a Duncan recording wattmeter. At the centre of the board an Esterline recording volt meter has been installed. The circuit breakers are I.T.E. type.

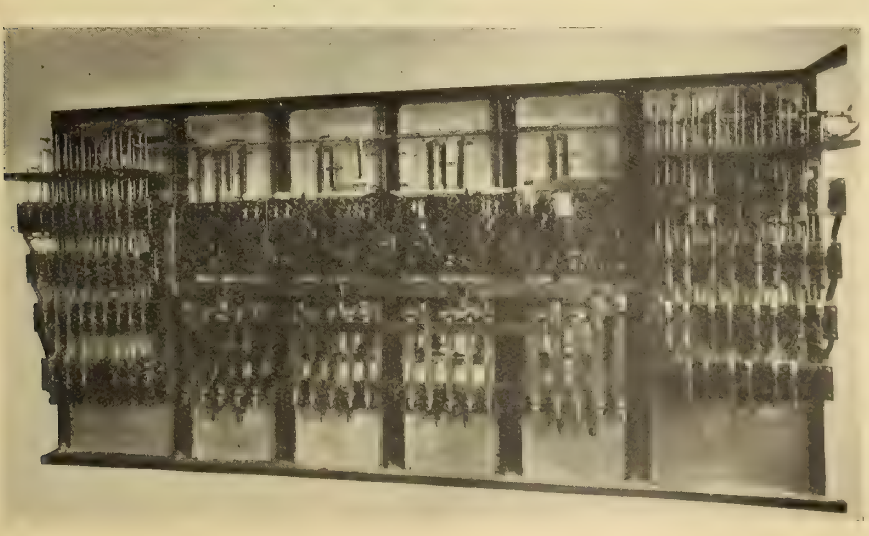


Fig 2—Rear of Switchboard

All generator cables come up through the concrete floor in bushed sleeves which enables all feeders to be carried plumb in the heels of switches and circuit breakers. All feeders throughout the building enter a 15 ft. x 3 ft. x 4 ft. steel junction box where all cables are brought through bushed holes to their respective switches. This does away with all the loose cable work so generally seen under similar circumstances.

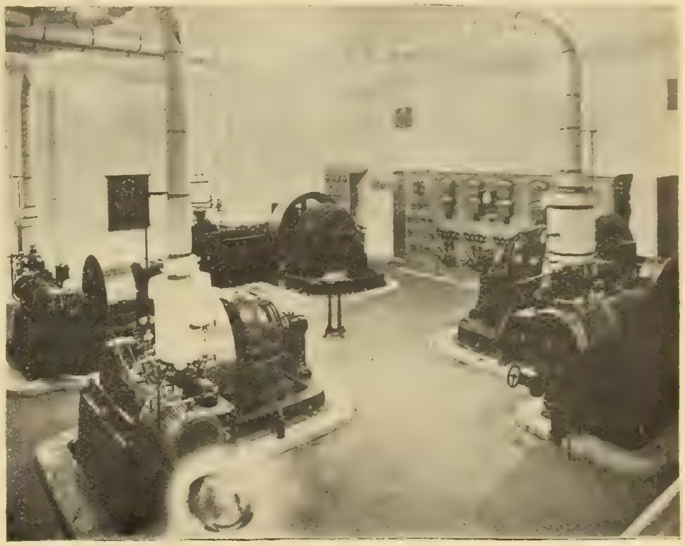


Fig. 3—Steam-electric plant

The generator room also contains a small motor generator set, 50 amp. 20 volts, chiefly for storage battery work. This is controlled by a battery board which works in conjunction with the motor generator and the batteries through eight branch switches, one motor switch, one generator switch, and two charge and discharge switches. This board carries three ammeters and one volt meter, pilot lights, etc.

The battery consists of sixteen 20 amp. hour cells. These are used chiefly for the telephones, call bells, and annunciators. The building contains 52 telephones which will be under the control of the bank's own switchboard in a specially planned telephone switchboard room. This central telephone room will also be used as a central for the automatic air pressure messenger system which is installed throughout the building.

The electrical equipment also includes a system of electric clocks which will be under the control of one master clock. This means that if the master clock is correct, so are all the other clocks in the building. There will be seventeen clocks in all, including the master clock, which is located in the clerks' lunch room on the second floor. Two of these clocks will present a particularly handsome appearance. These will stand in the balcony of the main public banking room, one on either side, and will have 16 in. marble dials.

A vacuum cleaning system which reaches every room in the building and is, of course, electrically operated, is automatically controlled by a solenoid switch from sixteen 3-way, momentary contact, lock switches placed at different points in the building which start and stop the motor in the sub-basement.

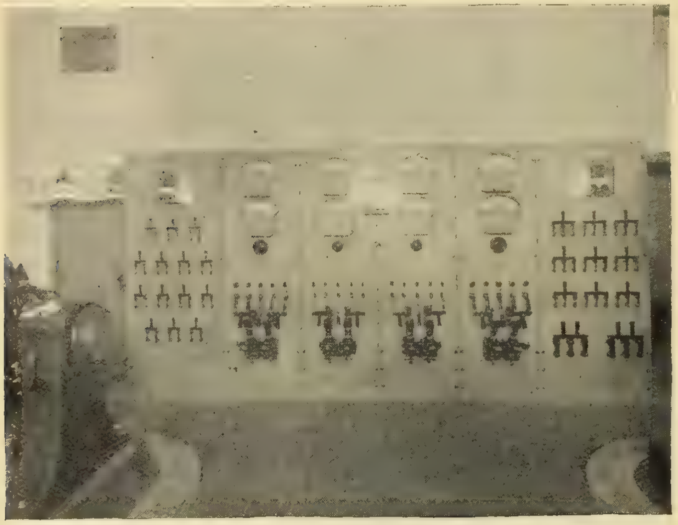


Fig. 4—Handsome switchboard of Tennessee marble

All the wiring has been done in conduit. The switches used throughout are the Metropolitan movable mechanism switch. The conduit was supplied by the Conduits Company, Limited. The necessary condulets were supplied by the Crouse-Hinds Company. The wire was supplied by the Hebershaw Wire Company, New York; the base receptacles by the Bryant, Chapman Company; the floor receptacles by Thomas & Betts; the annunciators by Edwards, New York; clocks by the E. Howard Clock Company, New York.

As representing the general use to which motors can be put in an installation of this type, the following list representing an approximate total of 100 h.p. is interesting. Two 10 h.p. motors are used to expel the hot air from the basement (the heating system is a combination, hot air and hot water); one 4 h.p. motor operates a fan at the fresh air inlet; one 10 h.p. motor drives the vacuum cleaner; one 10 h.p. motor supplies compressed air for the pneumatic tubes connecting the offices throughout the building through the central room spoken of above; one 10 h.p. motor circulates water for drinking purposes; two 10 h.p. motors are situated on the roof for operating the ventilating exhaust fans; two 3 h.p. motors operate in connection with sewage disposal; one 7½ h.p. motor operates a book lift; one 7½ h.p. operates a dumb waiter; one 7½ h.p. sprays water in the air washing room; one 10 h.p. motor operates a vacuum equipment for use with the elevators in emergency; one two h.p. motor drives a motor blast fan in the incinerator.

The work of installing the wiring equipment has been carried out by the Harry Alexander Company of New York and Toronto. This office, situated in the new Bank of Toronto Building, is under the supervision of J. M. Lindsay, as manager, and the installation itself was done under the personal supervision of Mr. H. Rohleder, superintendent of construction for the Harry Alexander Company.

Perhaps the most noticeable feature in connection with the electrical installations in this new bank however, are the lighting fixtures. These are being supplied and installed by the Murray-Kay Company of Toronto. A number of photographs of the beautiful fixtures used in this installation are shown herewith. At the entrance of the vestibule on either side of the doorways will be placed two beautiful six-light standards as shown in Fig. 1. These standards are of solid bronze, the detail on the shaft being all hand chased. The centre of the main banking room which occupies, in height, the first two floors is lighted by four 60-light electroliers which are probably the finest fixtures that have yet been installed in any Canadian public building. This is a semi-indirect fixture, the centre bowl being of alabaster specially carved and imported direct from Italy for this bank. All metal used in the fixture is of bronze, hand-chased and finished in real gold. Some idea of the magnificence and cost of these fixtures may be gathered from the dimensions; the diameter of the alabaster bowl alone is 3 ft. 6 in., while the diameter of the metal crown supporting the bowl is 5 ft. The height from the bottom of the fixture to the crown is 15 ft. 6 in., **Fig. 5.**

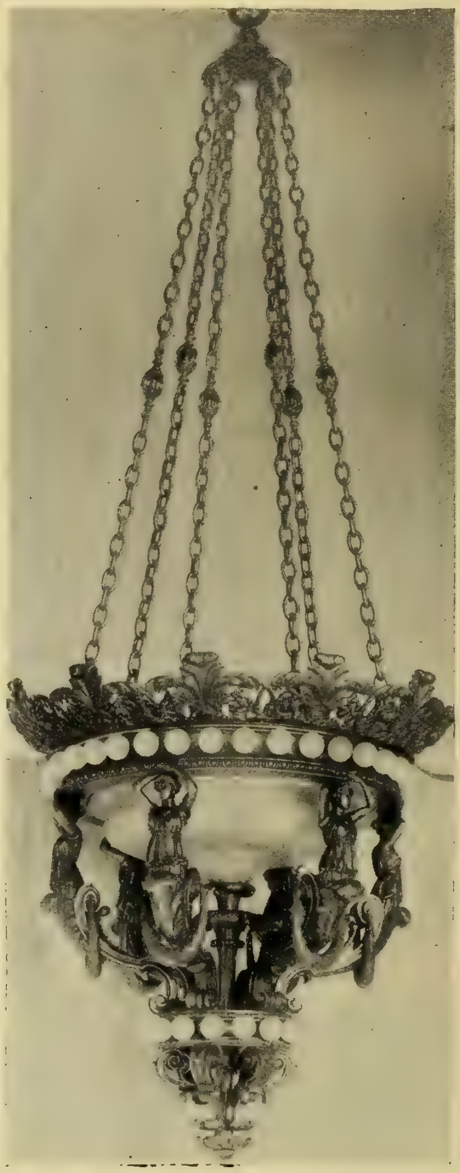


Fig. 5—Main banking room fixture, 15 ft. in height.

The main banking room is completely surrounded at the second floor level by a balcony or mezzanine floor which is lighted with eighteen 6-light ceiling fixtures finished also in real gold. A reproduction of this fixture is shown in Fig. **7.** The bowl is of alabaster also specially imported. The re-

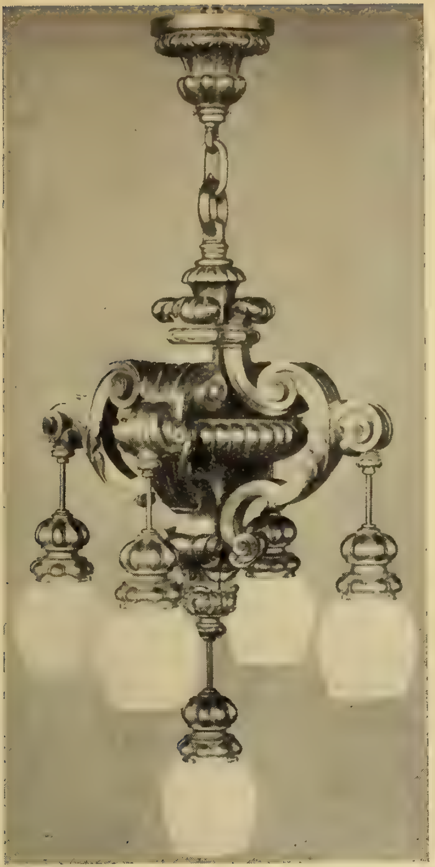


Fig. 6—Private offices

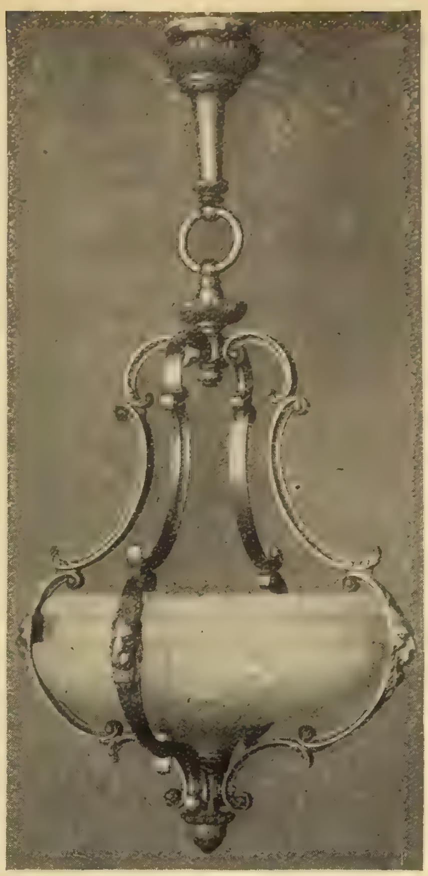


Fig. 7—Balcony

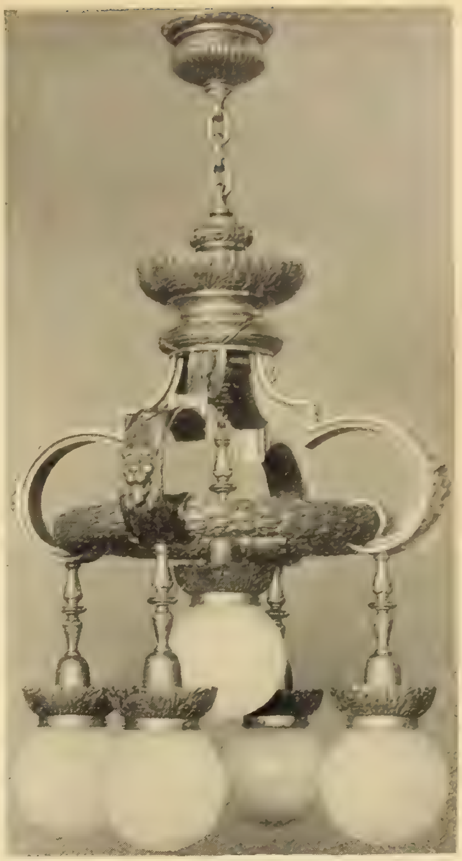


Fig. 8—Assembly room

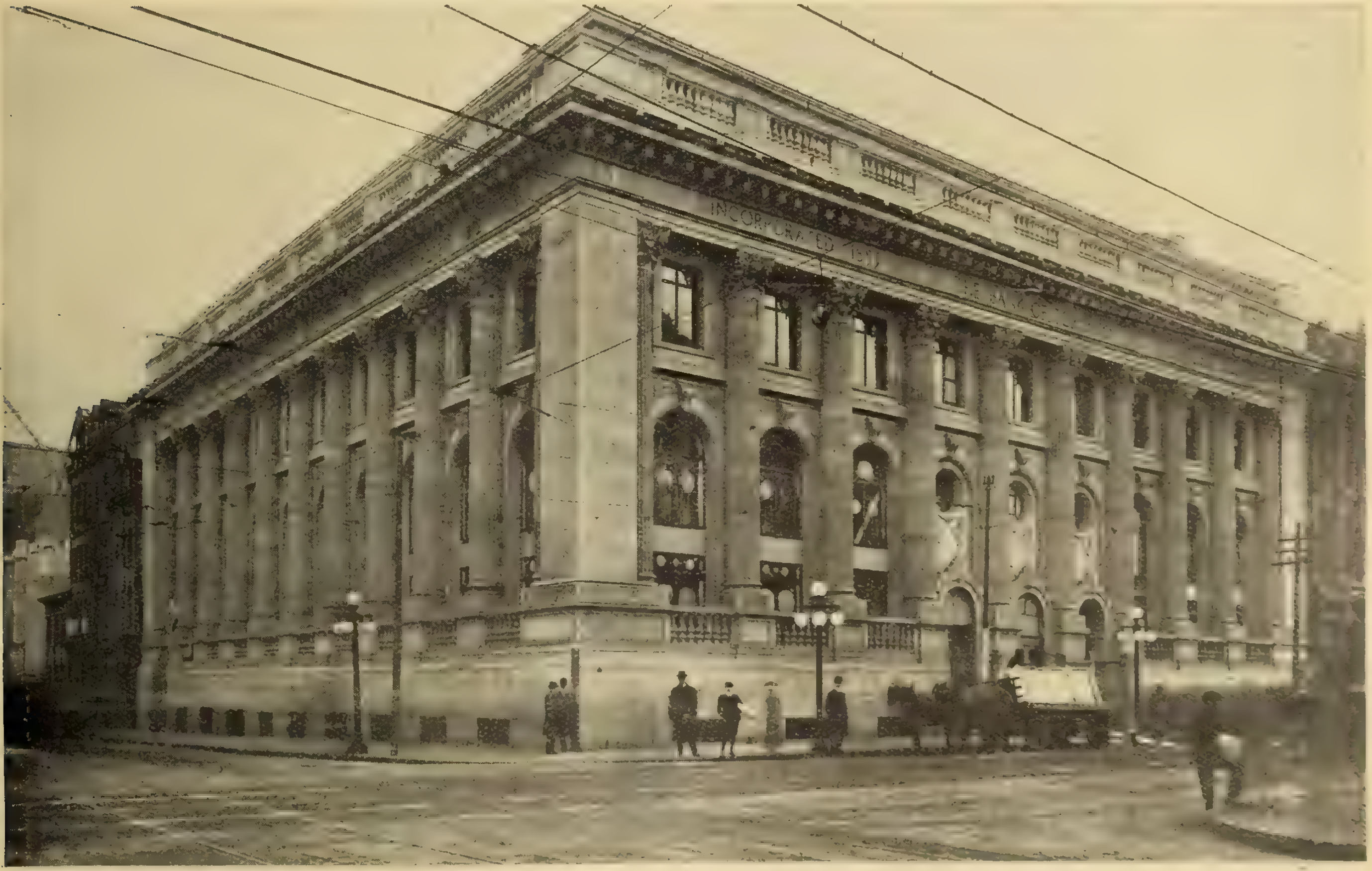


Fig. 9—Exterior view new head office building, Bank of Toronto, Toronto

sultant effect in this room both from an artistic and an illumination point of view is satisfactory in the extreme.

In the officers' rooms hand-carved wood fixtures are used, the finish being applied in real gold leaf. The high lights are brought out in a polished finish with the receding details in a dull gold, a combination of shades which greatly enhances the beauty of the fixture. The assembly room is lighted by four 5-light bronze fixtures finished in Vernis gilt. Every part of these fixtures is cast and hand tooled.

The entire lighting scheme is in accordance with the classical detail of the interior of the building and is certainly a marvel of design and execution which in its effect fully justifies the careful attention given by the architects to this building.

Successful Rejuvenation

The Jovians of Toronto held another rejuvenation on April 4th, which, as shown by the enthusiesm, was one of the most successful rejuvenations ever held in this city. Though barely two months since the last initiation ceremony was performed, thirty new candidates presented themselves for membership in this order. Included in these were a number from out of town who showed splendid promise of becoming enthusiastic jovians and who will now begin organizing leagues in their own cities throughout the province of Ontario.

Toronto Jovians pride themselves on the elaborate manner in which the initiation proceedings are carried out. The combination of a perfect Degree Team supplemented by Reigning Jupiter Frank E. Watts, jovian scenery and electrical effects made this rejuvenation more realistic than ever. One of the hits of the evening was when all the White Ball candidates were presented with hats similar to those worn by Dutch comedians. The galaxy of colors and the expressions on the candidates' faces, caused much merriment.

The Degree Team consisted of the following:—Reigning Jupiter, Frank E. Watts; Neptune, B. O. Saltern; Vulcan, W. F. Wright; Hercules, Ed. Malloy; Mars, A. K. Johnston; Pluto, Claude Warrington; Mercury, J. F. Ward; Aurenim, G. M. Scott; Apollo, H. C. Brown; Imps, J. R. Stacey, M. Culligan, H. S. Brown, H. A. Beach.

After the rejuvenation, a Joviation was held in the way of an electrical lunch at which there were sixty-five old jovians and thirty new ones. Music was interspersed with several interesting talks. The speakers included Mr. Chas. H. Dudley, Mr. R. E. T. Pringle, and Mr. D. H. McDougall. Statesman E. B. Pike was responsible in no small measure for the success of the evening. Arrangements are already being made for a midsummer rejuvenation to be held in the open air on the lake shore.

Jovian Notes

Statesman Bennett is arranging for a rejuvenation to be held in Montreal on the 19th inst.

The Jovian Luncheons in Toronto are well attended and some interesting addresses have been given. Statesman Pike desires to have the addresses of all Jovians in the district, to assist him in revising his mailing list.

Better Be Late Than Never

The Fort Wayne and Northern Indiana Traction Company has entered actively on an accident prevention campaign and is advertising widely in the daily and weekly press, the advertising taking the form of talks. It is said these talks appear in more than 30,000 newspapers which cover a local population of about 200,000 people. The following "talk" is typical of the series being run by this company.

"For a safe and sane everyday.

"The serious injury or death of a human being in a railway accident calls forth the keenest sympathy of the public and all connected with this company. A careful study of the past records has shown us that practically all accidents are avoidable if everyone thinks before he acts and thinks of safety first. Co-operation will do this where everything in the past has failed in part at least. All you have to do to join this safety movement is to

"Think,
"Never take any chance,
"Get the safety habit,
"Set the safety example—daily."

The Corporation of Megantic, P.Q., have retained the services of Mr. Edward A. Evans, Mem. Can. S. C. E., to prepare a hydro-electric plant for the commercial lighting and power required for the town. It is probable that the dam will be about 65 feet in height.

Toronto Sons of Jove—One hundred members making merry at an Electrical Luncheon

Important Problems in Telephone Work

Electrical Interference Between High Tension Circuits and Telephone Circuits—The Remedy in Theory and Practice

By Mr. C. A. Buckard

The problem of electrical interference between high tension circuits adjacent and parallel to telephone circuits producing disturbing influences in the telephone system, present an important problem to both the power engineer and the telephone engineer.

The problem is not a simple one and each individual exposure between high tension circuits and telephone circuits requires special treatment although general lines of procedure towards remedying the trouble can be followed. With proper co-operation between the power engineer and the telephone engineer and a certain degree of fairness exercised by both, the troubles caused can usually be eliminated to a satisfactory degree without undue expense to either of the interests involved.

It has long been clearly understood that an electric circuit transmits energy not through the body of its conductors, except to an almost negligible extent, but through the dielectric surrounding the circuit. The conductors are but a guide for energy in its course of transmission through the dielectric. The extent of surrounding dielectric which is energized is known to depend on the voltage, power and electrical constants of the circuit and the geometric disposition of the conductors in a plane perpendicular to the circuit. Modern electrical theory assumes fields of electromagnetic and electrostatic force, as a means of explaining the nature in which the dielectric is energized and also the phenomena of induction. If a foreign electrical conductor lies in these fields of force, any change in the intensity of these fields introduces a voltage or current in the conductor; these being the effects of the phenomena of induction either electromagnetic or electrostatic depending on the kind of field of force in which the conductor lies. Therefore when a telephone system exists in parallel proximity to high voltage or high power alternating current transmission systems there is usually interference in the telephone circuits.

Interference between high tension circuits and telephone circuits is of three fundamental kinds, i.e., telephone circuits parallel and adjacent to a high tension circuit are subject to effects due to electrostatic induction, electromagnetic induction, and leakage. These effects are not separate and independent, but are often mingled in an intricate and confusing way and manifest themselves usually as noise in the telephone receiver.

Under particularly favorable conditions and with all the factors known, mathematical calculations of the induced current are possible. These formulae, however, are not of great value in practice as they neglect insulation conditions of the circuit involved, and it is very difficult to get accurate enough basic data of line characteristics to justify the detail calculations.

Further development of formulae could probably be made for the various combinations of alternating current power circuits and telephone circuits under conditions which might be more or less realized in practice but as soon as one has to deal with more than three or four conductors the formulae become very complicated and are practically unmanageable. Mathematical solutions wholly, involve calculations of capacity and inductance. For telephone circuits this would mean the calculations of split capacities and inductances, that is to say, the capacities and inductances of phantom circuits, and these depend more or less on assumptions as to conductivity of the earth, etc., not actually realized and which are really unknown quantities unless measured. In actual practice we leave such calculations of complex circuits to those who delight more in mathematical exercises than in experimental determinations of values.

While usually none of the factors which tend to produce noise current in the telephone circuit occur separately, it is possible to develop methods of remedying the different factors by considering the effects of each individually.

In general, interference with telephone circuits from direct current circuits is nil except in the case of leakage from the direct current system. This manifests itself usually as electrolysis of the telephone plant, mostly of the cables, and seldom causes trouble in the telephone circuit except that of a complete breakdown of all circuits when the electrolysis has eaten the lead sheath of the cable and moisture has entered the paper insulation.

Direct leakage from alternating current circuits to telephone circuits is difficult to prove except by seeing actual contact, but frequently, from experience, it seems the only reasonable solution of the intensity and potential of the foreign current which is sometimes flowing in the telephone circuit. Poor construction and low insulation, broken insulators, line wires accidently grounded by guys, trees touching power wires, all coupled with similar conditions in the telephone system make such a condition possible. This condition has existed and has been remedied at considerable expense, by overhauling whole telephone plants. It has caused telephone companies affected to carry a much higher grade of maintenance than would be necessary if a similar high grade of construction was used by the power company. If leakage, i.e., low insulation, exists only on either the telephone circuits or the power circuits alone, the interference is of an inductive nature.

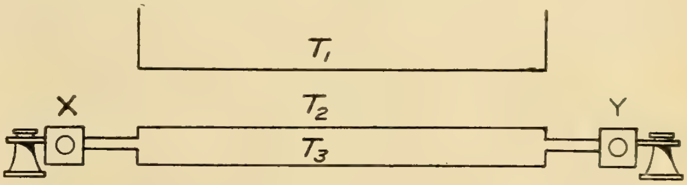


Fig. 1

When considering the effects due to induction, whether electromagnetic or electrostatic, one must bear in mind that the whole science of having a perfectly quiet telephone line in a foreign electromagnetic or electrostatic field is dependent on the Wheatstone Bridge principle, that no current will flow in the wire or instrument connecting two points at the same potential even though these two points are on conductors of considerable magnitude. The practical application of this principle requires that each wire of a telephone circuit shall have the same resistance, the same inductance, the same capacity and the same insulation resistance, and more exactly that these conditions of equality shall hold not only for the circuit as a whole, but for each and every short section of circuit. In practice these ideal conditions can be obtained only approximately, but sufficiently balanced conditions can be obtained to make the great majority of the telephone lines commercial.

Electrostatic induction manifests itself both as current in the telephone circuit and as voltage between the telephone circuit and the earth. In Fig. 1 T_1 is a power or high tension circuit. It will induce in the telephone wire T_2 a certain charge, of a potential greater than a similar charge which it will induce in the telephone wire T_3. The differences in charges is due to difference in electrostatic capacity, it being assumed that one wire is farther away from the power circuit than the other, which is the usual condition. Immediately a difference of potential exists in the circuit through the telephone instruments X and Y, and a current will flow attempting to equalize this difference of potential. As the alternating voltage of the power circuit goes through its cycle, so will an induced current in the telephone circuit go through a corresponding cycle, and theoretically 180 deg. in phase displacement from the primary voltage. Without going into the theory of transposition, if the mutual relation of the telephone circuits and the power circuits is changed, that is to say, if the telephone circuit is transposed against the power circuit at the centre of the exposure (Fig. 2) the current induced will be reduced to one-half its former value. Theoretically this process may be continued until the foreign current flowing through the telephone is so small that it is negligible. Sometimes when conditions are extremely unfavorable it is physically impossible to introduce sufficient transpositions to reduce the induced current to such a point that a commercially quiet circuit is obtained.

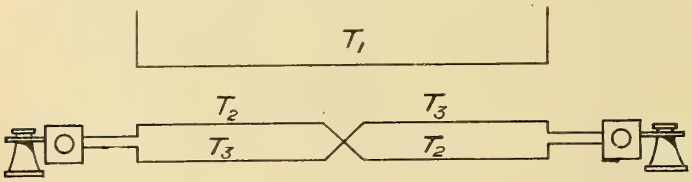


Fig. 2

Between the power circuit of Fig. 1 and the ground there exists a potential depending on the method of operation of the power circuits, that is to say, whether one, two or three phase with or without a grounded neutral. According to the theory of equi-potential planes the conductors of the telephone circuit would lay one in one plane and the other in a second plane or perhaps both in the same plane, the exact potential of each conductor above the ground being determined by its mutual capacity with the power circuit and the ground capacity of each wire of the telephone circuit. The potential above the ground which is induced will not cause a serious induced current in the telephone circuit, provided the insulation of the telephone circuit is balanced and the inductance and capacity to ground is balanced and the circuit is transposed properly against the high tension circuit. However, if one wire of the telephone circuit is of low insulation an alternating current will flow, as a difference of potential will exist between the sides of the telephone circuit depending on the leak to ground through the low insulation. This latter fault causes probably a greater portion of the noise current in parallel adjacent telephone lines and power lines than is generally supposed.

It frequently happens that the telephone line adjacent to the high tension line is quiet, that is, it is perfectly balanced, but when this is switched to another telephone circuit which is unbalanced the connection becomes noisy. However, the unbalance in the connecting telephone circuit is not serious for the normal operation of that circuit by itself as this circuit does not lie in the field of disturbance. To illustrate, in Fig 3 we have a power line T_1 and a telephone circuit T_2, T_3, the exposure between the power circuit and the telephone circuit being only a short portion of the total length of the telephone circuit or connection. Some miles distant at a point G, there is a high resistance ground, that is, low insulation on the wire T_3, causing an unbalanced condition of insulation on the circuit as a whole and hence causing a current flow. These leaks may consist of slight tree grounds, careless bridling of run offs, etc. This sort of trouble may be remedied at the sacrifice of efficiency of telephone transmission by increasing the insulation of the exposed portion, and isolating this portion of the telephone circuit with one to one ratio transformers. In telephone practice these are called repeating coils.

In the preceding, attention has been paid to insulation unbalance, but capacity unbalance gives similar trouble and is experienced sometimes in cables, especially in connection with phantom circuits, a description of which is given later.

For ordinary operation, away from a foreign field of force, considerable unbalance can exist in the telephone circuit and yet service can be given. When a telephone circuit, however, is in parallel proximity to a foreign circuit, these unbalances give trouble and particularly so when these foreign circuits are of a high potential. When a telephone circuit has been finally obtained which is quiet in the vicinity of a power circuit it is in a state of unstable equilibrium as so many slight and unavoidable causes will effect its balance. This condition causes the ones responsible for the telephone circuit to pay particular attention to these circuits and increases the cost of maintenance greatly.

In the preceding, attention has been paid to effects of balance or unbalance in the telephone plant when operating in the vicinity of a power circuit. Suppose under normal operation of the power circuit, with balanced load and insulation, we have obtained a quiet telephone circuit. If anything occurs to unbalance the electrostatic field surrounding the power circuit such as to increase the intensity of that field, the effects are almost immediately felt in the telephone system.

In high tension systems not employing a permanent ground at some portion of their circuit, such as a grounded neutral, any condition of low insulation on any one of the line wires causes practically full line voltage to exist between the other wires of the circuit and the earth. Slight tree grounds, punctured, broken or cracked insulators will cause this. In polyphase circuits unbalanced load conditions will also cause this. As the induced current is increased in proportion to the intensity of the electrostatic field, the telephone circuit perhaps becomes uncommercial wherein sufficient transpositions have been previously introduced such that under normal operation of the power circuit the telephone circuit is quiet. Or perhaps the earth potential of the telephone circuit which under normal operation of the power circuit is permissible, mounts up to sufficient values to operate the protectors in the telephone circuit grounding perhaps one side of the line. When normal conditions again prevail in the power circuit the telephone circuit remains noisy until this ground is found and removed. Thus the telephone circuit may be out of commission a much longer time than the power circuit which has caused the trouble.

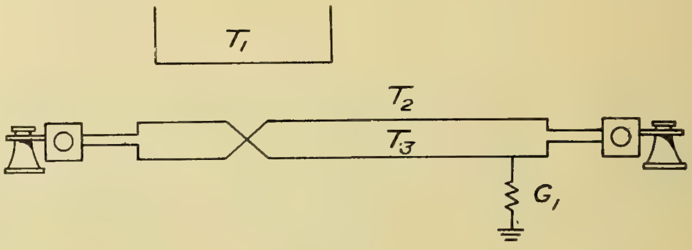


Fig. 3

While it is realized that any power line is liable to trouble, reliability of service demands that there be a minimum of trouble on the lines. Notwithstanding this there are operating comparatively high tension transmission systems of old type of construction which get into trouble so frequently, and operate under such frequently changing load conditions that it is almost impossible to give satisfactory telephone service in their vicinity.

Electromagnetic induction from power circuits to telephone circuits under certain conditions is a serious disturbing factor in the operation of the telephone circuits. Theoretically a voltage induced in a telephone circuit from a parallel power circuit by electromagnetic induction, can be eliminated by a single transposition introduced into the telephone circuit at the middle of the exposure. Considering the laws of electromagnetic induction this can be seen by an examination of Fig. 2. The potential in the portion of the circuit on one side of the transposition will be equal and opposite to the potential on the other side of the transposition, thus neutralizing each other.

It sometimes happens where the power circuit makes use of a ground return, such as a single phase railway or a transmission system employing a grounded neutral through which a strong current flows, that a serious earth potential is introduced in the telephone system due to electromagnetic induction giving rise to effects similar to those described where an earth potential exists due to electrostatic induction. In cases like these, with the exception of a single phase railway, it would appear that it is the duty of the power company to change conditions in their plant such that an earth current does not flow, or else use some means to reduce the extent of the electromagnetic field.

In polyphase circuits employing a grounded neutral, at both the generating and receiving end of the line unbalanced load conditions cause a current flow in the neutral circuit. The obvious remedy is to balance the load which will overcome the difficulty or remove the ground from the neutral. This latter procedure may give rise to increased unbalanced electrostatic conditions which might give trouble. In three-phase circuits employing a grounded neutral an important factor is the well-known fact that the third harmonic of the impressed e.m.f. of the power circuit exists in the circuit of the grounded neutral and possibly the ninth harmonic and still higher harmonics. Induced current of low frequency in telephone circuits, such as frequencies of 25 cycles or under, are not as annoying in the telephone circuit as current of higher frequency. Probably the noise of an induced current of 25 cycles would not be noticed by an ordinary telephone subscriber, but any noise from a current of frequency above this would begin to be noticed. From a three-phase system of 25 cycles with a grounded neutral the frequency of the induced current might be 75 cycles or 225 cycles, the noise from which would be distinctly audible. By listening to the pitch of the tone in the telephone receiver connected to the exposed circuit it is often possible to obtain considerable evidence as to the importance of the neutral ground when investigating trouble due to exposures between three phase circuits and telephone circuits.

Certain three-phase high tension transmission systems, by use of the neutral ground make use of the earth as a conductor where a cheap type of plant is wanted, causing a very bad unbalance both electromagnetic and electrostatic. It would seem that this practice in comparatively thickly settled communities should not be allowed as it puts an unreasonable burden on the companies which exist for the transmission of intelligence and who should not be forced to put up an expensive type of construction in order to operate, on account of the extremely cheap method of construction which may be employed by the company which exists for the transmission of power.

Where it is not possible for the power company to take such steps in constructing their plant, to remove dangerous or disagreeable voltages from the telephone lines due to the method of operation of the power company, there is a method of reducing earth potentials in telephone conductors by a compensator. This is not especially desirable and has serious objections. A compensator is a transformer with windings of such a ratio that when the secondary or secondaries are connected to the telephone circuits the voltage from it is equal and opposite to the voltage induced from the power circuit. A type of this apparatus has been used where the ratio between the primary and secondary windings is approximately unity, the primary being connected to one or more of the telephone circuits which were grounded through the neutral point of transformers. The locations of compensators in the telephone circuit have to be made as a result of special studies of load conditions in the power circuits. This procedure is now recognized as the best available practice when dealing with single phase railway exposures, but requires the use of extra conductors, the burden of expense of which may be considerable.

Another method of taking off potential to ground from telephone circuits is to ground the exposure portion of the circuit by drainage coils. This is a high impedance bridge with the middle point grounded. The connection is such that there is a high impedance path across the telephone circuit to the talking currents and a non-inductive path to ground for the induced or foreign current. This procedure is open to objection as it damages telephone transmission and the apparatus has to be protected with fuses and open space cut-outs which are somewhat difficult to maintain, and there is difficulty in getting good grounds especially in severe weather when a driven ground is liable to freeze. This method has been tried here in Canada with some success towards reducing the voltage to earth and reducing noise but the difficulties stated were experienced.

Other methods of reducing the induced current by reducing the extent and intensity of electrostatic and electromagnetic fields may be used, such as closing up the spacing of the power circuits or of the telephone circuits, or the running of ground wires close to and parallel to power or telephone circuit. The applicability of any of these schemes depend on conditions of exposure which are encountered and have to be the result of study and co-operation between the power and telephone engineers.

(To be continued.)

Telephones at the Coast

As indicating the extensive nature of the B.C. Telephone Company's development schemes in different parts of the province, it is interesting to note that in Vancouver during the past year or two, three suburban exchanges have been built, and this year the company will erect a six-storey building for headquarters for the plant department, and an eight-storey building to be used as head offices, and provide accommodation for three central exchanges to serve the district now looked after by the Seymour exchange. At New Westminster, extensive alterations are just being completed. A new cable has been placed across the Fraser and additional circuits strung in the section south of the river. In North Vancouver an estimate for more work has recently been approved. An exchange will be established at West Vancouver. In South Vancouver, a new building was recently completed at Collingwood, and a new exchange is to be erected at Fraser. Construction men will be busy in Point Grey this season. On Vancouver Island large expenditures have been made in Victoria, where a new exchange was occupied last year, but all the work laid out will not be completed for some time yet. In the district between Victoria and Nanaimo, equipment in all the exchanges has been improved. At Nanaimo, where the big cable will land, the city system has been made most modern. New toll circuits are being strung to Parksville. At Alberni a cut-over took place on March 1st. In the interior, Kamloops now enjoys the better facilities of a common battery exchange, and the

Nelson system is expanding rapidly, while an exchange will shortly be established at Kaslo.

Handy Soldering Device

Most of the outside plant men of the B.C. Telephone Company are in the habit of carrying small galvanized "cans" which have a slit in the top. This "can" is a simple soldering device, originated by local talent, and has been christened the B.C. Telephone Company's Soldering Torch, to distinguish it from inferior styles of torches made from tobacco cans.

The object of the torch is to provide a quick method of soldering and does away with the slow gasoline torch. A candle is used as the heating unit, and the splice to be soldered is laid across the slit in the top. The flame is applied directly to the splice and the soldering done on each side of the flame. The whole outfit costs only a few cents. It is six inches high by two and a-half inches wide, and one and a quarter inches thick. A drop from the top of a pole only serves to increase its usefulness.

Lineman using soldering outfit

The torch can be cleaned by taking out two small bolts and removing the lower part of the torch. Draught is scientifically provided for the candle which can burn undisturbed in a brisk gale owing to the can being windproof. It is hoped with the use of this device to eliminate loose connections which result so often in intermittent trouble. The soldering operation is simple, but its importance in giving the subscriber a perfect line being emphasized. It is pointed out that if care is take there will be few cases of trouble due to imperfect soldering.

Mr. Patterson, Vancouver drop foreman, for the B.C. Telephone Company, is the patentee, and is ready to explain his torch and back up the claims made for it. His men are using it and praising it highly.

Telephones in Forest Work

The forest branch of the Department of Lands for the province of British Columbia has just issued a report for the year ending December 31st, 1912, in which the use of telephones as a valuable auxiliary in forest preservation from fire is discussed. It is calculated that telephone lines could be strung at a comparatively small expense (from $30 to $80 per mile has been mentioned) and in conjunction with better roads would be the means of giving prompt assistance in the case of a fire outbreak which would often prevent the spread of forest fires. The report outlines a plan of trunk telephone lines and it is claimed that their construction will save money both in timber and in the number of men needed for patrol. To build these lines, which could be for the most part treelines, an expert telephone engineer will be employed to prepare plans and supervise the construction as it proceeds. The trunk lines as suggested aggregate approximately 1,000 miles of line. The report adds that as soon as weather permits, work will begin on field telephone lines to the extent of 175 miles.

Line Extensions

Development on Vancouver Island has demanded great activity on the part of the B.C. Telephone Company. Preparations are now under way for the extension of the company's system in the Oak Bay district, and also in the Victoria West and Equimalt section, Vancouver Island. A main feeder cable will be installed in Oak Bay, and a main feeder will also be placed to provide Victoria West and Esquimalt with better facilities. This work will be undertaken in the near future. Last year the company expended between $30-000 and $40,000 in Oak Bay so that telephone service might be provided the large number who had taken up homes in that district, but the growth has been so rapid that considerably more work is required. A construction gang is now at work on the toll line between Nanaimo and Parksville, and in a short time this new line, twenty-three miles in length, will be completed.

Personal

Mr. Geo. D. Leacock has been appointed manager of the Winnipeg office of the Packard Electric Company, Limited.

Mr. W. N. Warburton has been appointed general manager of the London & Lake Erie Railway and Transportation Company.

Mr. Patrick Dubee, secretary-treasurer Montreal Tramways Company, and president of the Canadian Street Railway Association is in England.

Mr. G. C. Murray, formerly of the Bell Telephone Company, London, has been appointed telephone inspector, Grand Trunk Railway Company, Stratford, Ont.

Mr. Arthur Skidmore has been appointed chief of the Grand Trunk power house at the Stratford shops, in succession to Mr. A. Kastella, who has been transferred to Ottawa.

Mr. S. B. Hammond who has been with the Porto Rico Railways in San Juan, Porto Rico, for the past two years has returned to Montreal to assume his new duties of secretary of the Montreal Engineering Company, Limited.

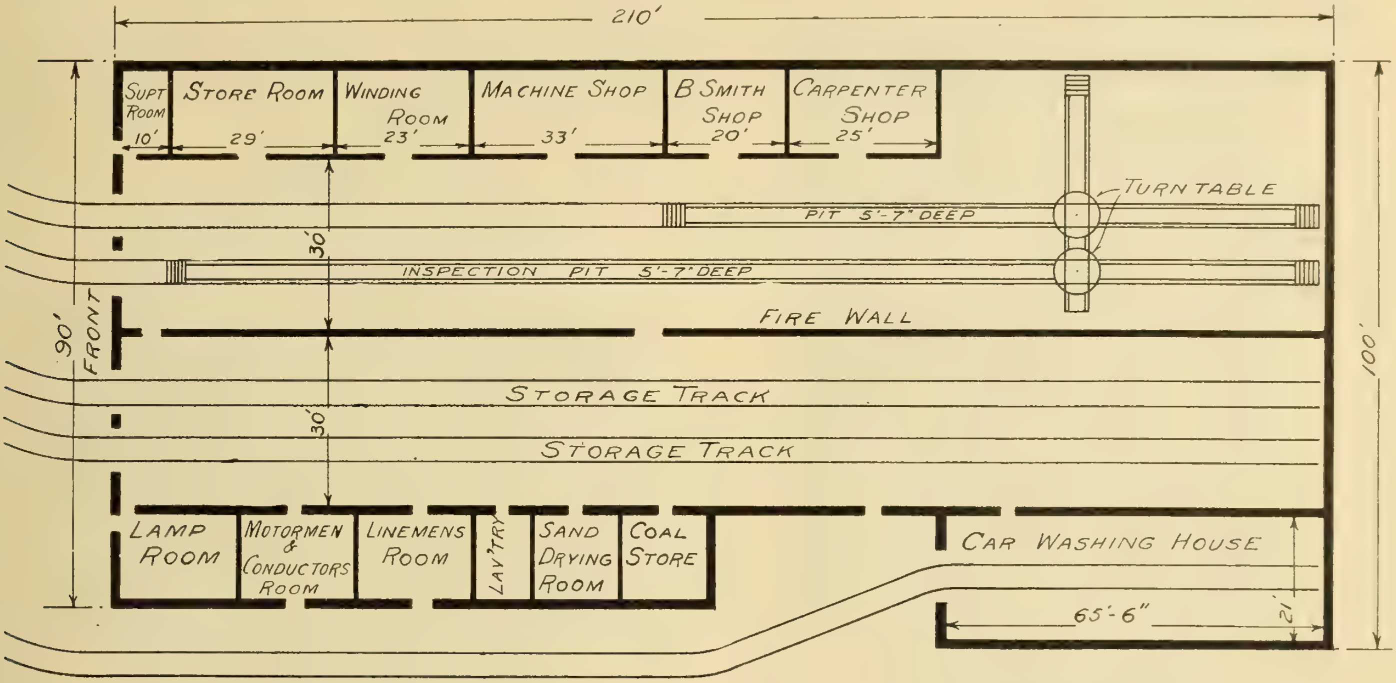
Mr. F. A. Gaby, chief engineer of the Hydro-electric Power Commision of Ontario, is in Europe on business connected with the extensive work to be carried on this summer in south-western Ontario. Mr. Gaby is accompanied by Mr. H. D. G. Crerar, one of the Commission's assistant engineers.

Mr. Charles Robbins who, since 1909, has been manager of the industrial and power department of the Westinghouse Electric & Manufacturing Company has been appointed assistant sales manager of this company with headquarters at East Pittsburgh. Mr. J. M. Curtin, assistant manager of the industrial and power department has been appointed manager.

ELECTRIC RAILWAYS

New Barns London & Lake Erie Railway Company

A recent issue of the Electrical News contained a description of the new car barns of the London & Lake Erie Railway Company and we are now able to reproduce a line drawing of the same. These car barns are located at St. Thomas which is about midway between the terminals of this road which operates between London and Port Stanley, a distance of some twenty-two miles. This line is now operated by power supplied by the Hydro-electric Power Commission of Ontario. The main car barn is 210 ft. x 95 ft., and the whole of this company's passenger rolling stock, namely, sixteen 55 ft. cars can be accommodated. As seen from the sketch the building has two pits, one the whole length and the other about half the length which enables easy inspection and repair of the car equipments. The general lay out of the barns with reference to offices, rooms, etc., can be seen from the accompanying sketch. Mr. W. N. Warburton has recently been appointed general manager of this company.



Sketch of floor plan of the London and Lake Erie Railway Company's new car barns

Relative Values of d. c. and a. c. Operation

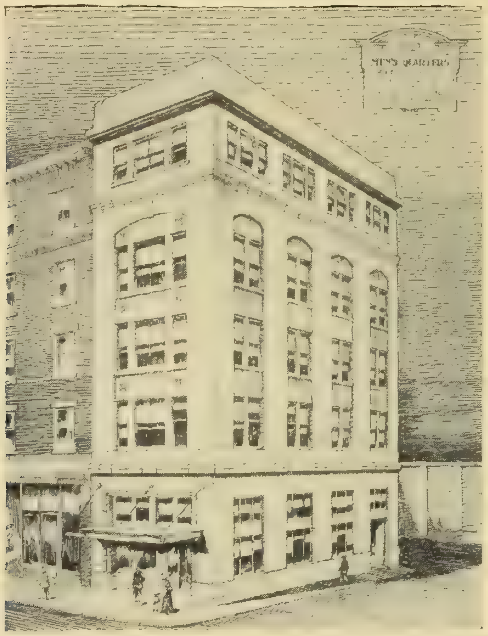
At a recent meeting of the New York railway club, Mr. Frank J. Sprague, of New York City, speaking on the relative merits of the various systems of high voltage a.c. and d.c. railway operation described briefly a number of features of his original Richmond equipment in 1889 and told of his early advocacy of direct current operation at 1,200 volts and higher. Referring to the old controversies about the merits of single-phase alternating current and direct current, Mr. Sprague said that too much had been expected of the former and too little attention had been paid to the possibilities of the latter in making use of higher line and motor voltages. The development of electric traction had now reached the point where one could specify the normal maxima in operating potentials on the working conductor at which there would be established a balance of advantages and disadvantages for any system. These potentials were about 6000 volts for polyphase operation, 11,000 to 15,000 volts for single-phase, 1200 to 1500 volts for direct-current with protected third-rail and from 2500 volts to 300 volts with direct-current trolley. There were inherent differences in the weights and costs of single-phase and direct-current motor equipments, when built and operated under like conditions of reliability, which were irremedial and which would be found in a large measure to offset whatever advantages might be achieved in efficiency of the secondary transmission. In view of the coming necessary interconnection of power supplies in which railroad use would be but one of many, and arbitrary cycle adoption for trunk-line operation was of questionable advisability. It was only after the inevitable development of each of the systems to its natural limit that any ultimate determination could be made regarding their relative values.

Referring to the idea of a Technical Commission who would make a study of the various systems of electrification as applied to any particular situation, Mr. Sprague said that much progress had been made. He felt justified in stating that the principal manufacturing companies were now favorably inclined to the creation of a technical commission to be composed of disinterested engineers of wide and varied experience who should make a thorough study of the various systems of electrification as applied to such situation or situations as might be taken up; that they were prepared to bear a part, or, if necessary, to meet the entire expense of such a commission; that they were in favor of some scheme of financial development which should relieve the railroads of part of the burden of raising capital, and finally that they awaited only the necessary co-operation of railroad officials to make effective this joint effort to avoid the heavy costs of mistakes due to individual judgment on the threshold of a great electrical development in transportation.

Building For Employees

The management of the British Columbia Electric Railway Company, Limited, have called for tenders for the construction of a building for the use of their motormen, conductors and shop employees who are stationed in Vancouver. The building will be located at the corner of Main and Prior streets, in the heart of the city and directly opposite the principal car barns in Vancouver and the repair shops maintained at that point. The block will be 25 feet by 60 feet in size, and five storeys in height. The type of construction will be of reinforced concrete with facings of brick and artificial stone. The estimated cost of the building is about $35,000.

There will be two entrances to the ground floor, one from Main street, and the other from Prior street. On the Main street frontage will be located the depot master's office and behind this, a large waiting room for the men. The entrance from Prior street is at the rear of the block, and leads to the elevator and stairways by means of which the upper storeys are reached. Above the ground floor the first floor will be used for lockers for the men, the second floor for a reading room, and the third floor for a billiard room, with room provided for one billiard and two pool tables. On the upper storey will be located the gymnasium for the men, the entire area of the floor being left clear for this purpose, and the room being 18 feet in height. The company will equip the gymnasium with a full outfit of apparatus. Lavatory accommodation will be provided on each floor, and shower baths are planned for the gymnasium. The entire building will be heated with hot water. Work will be started on the building at once, and it is planned to have it ready for use during the coming summer.



New Building for B. C. E. R. employees

Car Window Glazing

Who has not ridden in a street car and been annoyed by the ceaseless rattling of the glass in the side window sash, generally occurring, of course, in the city type of car? Glass set in putty is pretty sure to rattle in time unless the car and sash both are remarkably rigid in their construction and the roadbed is very smooth. The writer has experimented with several types of glazing and barring rubber, which is expensive and hardens with exposure to weather, no article of equal value has been discovered to the pleated or common felt. Felt lasts for many years, is inexpensive in the long run, costing about 12 cents for the average size glass, say 24 ins. by 28 ins., will readily fit any glass thickness from ordinary double thick to the heavy French plate, and can be used over and over again with only occasionally a lost piece. It cushions the blow when the sash are violently handled, either in raising or lowering, and also enables the glass to sustain a much greater blow without breaking than any other material. It can be used to reset a broken glass and the time consumed in the operation, where screw fastened beads are used, will only consume from 20 to 30 minutes, and anyone who has had to scrape and dig off putty from the sash of a putty-set glass, will readily see the saving; the latter operation frequently taking from one to two hours and then at a risk of badly bruising the sash. Assuming the labor cost to be 25 cents per hour, the time saved will pay for the felt used, to say nothing of the pleasure of having the car free from the disagreeable rattling and several degrees warmer also. On the road with which the writer is connected, the costs for glass alone were as follows:

In 1909, no felt used	$4.97 per car
In 1910, a little felt used	3.20 per car
In 1911, over one-half set in felt	2.96 per car
In 1912, all set in felt	1.06 per car

Weather conditions were very favorable in 1912, adding somewhat to the saving, but it is safe to assume that the saving in glass alone was over 50 per cent., while an even greater saving was, of course, made in the labor cost.

The felt used is about 1-16 in. thick, of a color to match the sash and is cut into strips 1¼ ins. wide, the length of a side of the glass. The ends of each strip are sharply pointed at each end, are laid over the perfectly clean rabbet in each, the glass pressed down firmly into place, the felt pressed down by beading screwed into place; then cut or trimmed close to beading with sharp knife. The felt, if properly installed, will never come out and there will never be a rattling glass, and when the latter becomes broken, on the removal of the beads, the sash is immediately ready for a new glass.—Electric Traction.

The Model Employer

At a meeting of the Labor Commission held in Vancouver during March, Mr. J. H. McVety, who appeared as the official mouthpiece of the B.C. Federation of Labor, paid a striking tribute to the B.C. Electric Railway Company declaring that the service both in the city and on the suburban lines had improved fully 100 per cent. within the last few years. Mr. McVety said that the motormen and conductors were satisfied with their hours and wages. Theirs was the model employer of all the street railway companies on the continent. The wages of the motormen and conductors ran from 24 cents per hour to 35 cents.

The executive committee of the Toronto branch of the Canadian Manufacturers' Association in a letter to the Mayor support the scheme of electric railway extensions on the local improvement plan as recently brought forward by Ald. Dr. Wickett. The letter states that the committee is of the opinion that a well planned general scheme of transportation lines administered by a board free from sectional or political influence, might be put into effect with advantage by assessing the cost of constructing the lines, in whole or in part, against the property benefitted and suggest that the council take an early opportunity of seeking the necessary legislative powers to carry this scheme to completion.

It is said that the engineers who will make a survey of the lines of the St. John Suburban Railway Company will commence work at once.

Illumination

Semi-Indirect Units

The favor with which semi-direct lighting is meeting both for commercial and artistic illumination, has led to a multiplicity of shapes and designs in translucent shallow bowls and placques. Such bowls and placques are designed to harmonize both in shape and in exterior elaboration with the interior finish of the building in which they are used. The variation in design is limited, in fact, only by the willingness of the glass manufacturer to provide the costly molds in which the bowls are made. The accompanying illustration shows a side and bottom view of a new Haskins-Lucida semi-indirect bowl of "Renaissance" design. The shapes shown are typical of the translucent semi-indirect bowl, though the design is more intricate and elaborate than common. The bowl is 20 in. in diameter and approximately 8 in. deep.

Haskins-Lucida Renaissance design semi-indirect bowl

The Toronto Electric Light Company has filed plans at the City Hall for an extensive underground system. The plans call for a net work of underground wires in the district bounded by Spadina, Bay, Sherbourne and Wellesley and St. Albans on the north.

The "Nulite" Tungsten Sign Lamp

The Canadian Tungsten Lamp Company, of Hamilton, Ont., have recently put a 12 volt, 5 watt sign lamp on the market and the sales department of the above company state that it has met with immediate approval and that the quantity on order is proof of the merit of this style of lamp for sign advertising work. The lamp is illustrated herewith. The saving these lamps effect should interest everyone who uses an electric sign, for considering that they give from two to four candle power more light than the carbon lamps, at one-third the operating cost, it is reasonable to expect all overhead signs soon to be equipped with this class of lamp. Fragility is overcome by the use of drawn wire filament, which allows these lamps to stand unlimited vibration and set in any position under the most trying conditions. The company have given their lamps the name "Nulite," as representing a new era in sign illumination.

Esterline "Golden Glow" Lamps

The Esterline Company, LaFayette, Indiana, who have been making a successful line of glass reflector type fog penetrating lamps for marine service, familiarly known as the "Golden Glow" lamps, has recently announced a line of similar construction for electric railways and steam and mining locomotive service. The design and construction of these lamps differ radically from other existing types, in that the reflector, instead of being a metallic or enamelled surface, as commonly used in most lamps, consists of a molded plate glass parabola, ground accurately to size and shape, then polished and silvered like a French plate mirror. The glass, by a secret process, is given a greenish-yellow color which is about the color of molten gold, hence the name "Golden Glow." A golden-yellow light will penetrate fog and mist to a much greater degree than will a white light, and many recent tests on the great lakes and the sea coast, show that Golden Glow lamps have wonderful penetrative power. The use of the Golden Glow reflector also renders the light from the lamp much less dazzling since it removes the actinic rays from the light, rendering it soft and mellow. Experience shows that, not only is the light much less dazzling to pedestrians, but it is also less fatiguing to the motorman or the engineer who is driving by it. The reflectors of the lamps, being made of glass, will never tarnish, but retain their lustre indefinitely. They can be cleaned without the possibility of harming or scratching the reflecting surface.

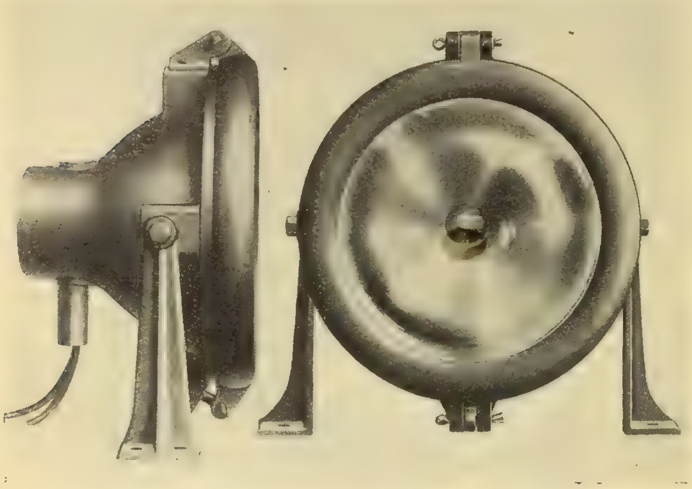


Fig. 1

The Golden Glow lamps for street railway, interurban, electric and steam locomotive service are built in two types. In Fig. 1 is illustrated the hood type lamp, designed for mounting on top of the car or locomotive. The dash type of lamp, in which a part of the lamp is recessed into the surface on which it is mounted, is illustrated in Fig. 2. The housings for the reflectors are of metal, and the glass parabola is securely held in place. The illustrations show the lamps with the bulbs removed. A standard spherical incandescent bulb is used with a standard Edison base. The sockets for the bulbs have a large, heavy porcelain support which serves to thoroughly insulate the lamp. The reflector, being of glass instead of metal, also reduces the possibility of grounds or short circuits. The front, or door, of the lamp is hinged at the top. The upper hinge is made adjustable, so that all play can be taken up and the front cover pressed tight against a gasket, rendering the lamp practically water and dust tight. The front glass is held in by means of spring clips which, while they hold the glass securely in place, distribute the strain in such a manner as to render cracking of the glass very remote. The lower clamp for the cover is of the thumb screw type with the screw turned back in order to keep it out of the way. In the design of the lamp, all unnecessary projections have been omitted.

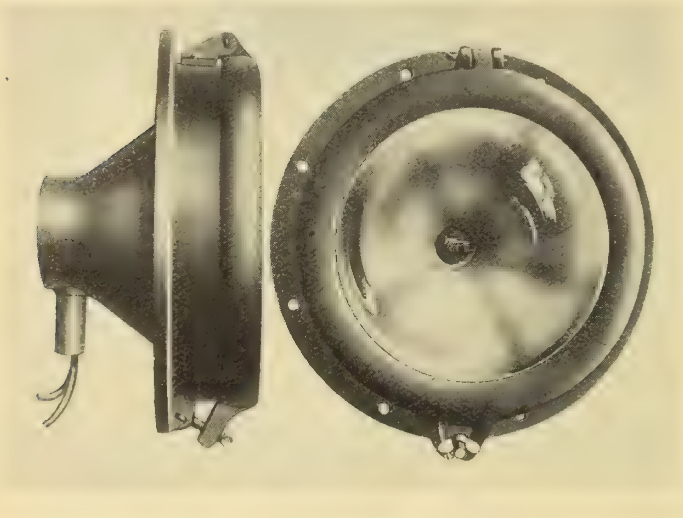


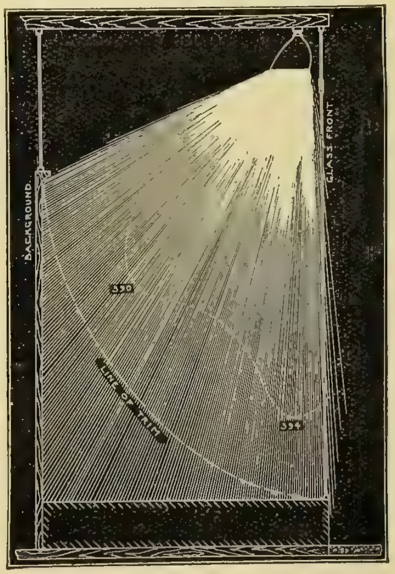
Fig. 2

The lamp body is ventilated in such a manner that while water and dust cannot enter, it permits of a ready dissipation of the heat, so the lamps will not sweat.

The 'Visor' Reflector

The X-Ray Visor reflector, Fig. 1, is the fourth of the exclusive line of X-ray opaque mirror reflectors designed ing the Helmet, the Scoop and the Poke Bonnet. There are solely by the National X-Ray Reflector Company for efficient and uniform store window lighting, the other three being the Helmet, the Scoop and the Poke Bonnet. There are so many store windows nowadays having comparatively low backgrounds, or backgrounds of transparent glass, or no background at all, that two additional requirements for scientific window illumination had to be met. The first was the problem of concealing the lamp from the passerby and onlookers in front of the window, and also from the people inside the store. Second, there must be no reflection of the glare of the lamp visible from the street, as this would seriously mar the attractive stage lighting effect. That is to say, a bright uniform light from hidden sources. The Visor reflector is claimed to meet all these requirements. It prevents light being wasted by passing over the background into the store, it hides the lamp from the ordinary range of vision completely, and covers the lamp in such a way that

The Visor Reflector



Distribution of Light by Visor

its reflection cannot be seen in the glass or polished background of the window. It is designed for use with 60 or 100 watt mazda lamps and uses a 2¼-in. "Form H" holder. The dimensions are, depth, front to back, 10 5/8 inches; width 9½ inches; height 8 9/16 inches.

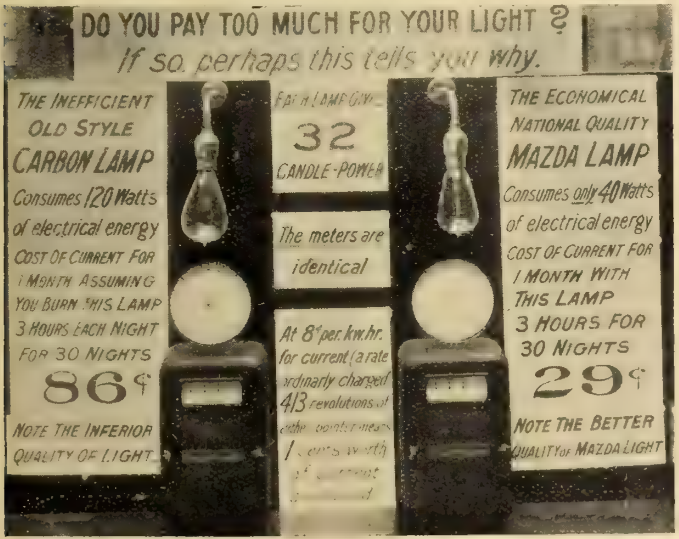
The X-Ray line of direct lighting reflectors for use in warehouses, factories, shops, over-counters, over special machinery, etc., has also been augmented by the addition of a new type of reflector, No. 710. Number 710 is a concentrating type of reflector and is used with 60 and 100 watt lamps. It will not take a 150 watt lamp, and the standard "Form 0" holder is used. Its dimensions are as follows: diameter 11½ inches; height 6¾ inches; holder 2¼ inches.

Concentrating Type Reflector

Good Advertising

The Sunbeam Lamp Company are distributing a little booklet entitled "Mazda Means Electric Light For Everybody" and are following these up by furnishing the various dealers throughout Canada with attractive window display cards and demonstrating machines. A reproduction of one of the demonstration ideas is given herewith. This is a two meter board display which demonstrates the practical economy of mazda lamps. The hand on the pan above the meter is turned by a vertical shaft from the meter disc and by its more rapid movement shows very clearly which meter is registering more current. The explanatory matter on this board display further emphasizes the great difference in current consumption with carbon and with mazda lamps.

Another demonstrating machine shows what is called a triangular dome bump test. This dome is made of plate glass and has illuminated advertising copy. The dome is revolved by means of a shaft and as it revolves tilts back and forth by means of a track upon which the dome is run. At one point on the track the dome falls about 12 in. and to the bystander it looks as though the whole outfit would be knocked to pieces. That the lamps take no harm greatly emphasizes their durable qualities.


DO YOU PAY TOO MUCH FOR YOUR LIGHT ?
If so perhaps this tells you why.
THE INEFFICIENT OLD STYLE CARBON LAMP
Consumes 120 Watts of electrical energy
COST OF CURRENT FOR 1 MONTH ASSUMING YOU BURN THIS LAMP 3 HOURS EACH NIGHT FOR 30 NIGHTS
86¢
NOTE THE INFERIOR QUALITY OF LIGHT
EACH LAMP GIVES
32
CANDLE-POWER
The meters are identical
At 8¢ per kw.hr. for current (a rate ordinarly charged) 4/3 revolutions of either pointer means 1 cents worth of current
THE ECONOMICAL NATIONAL QUALITY MAZDA LAMP
Consumes only 40 Watts of electrical energy
COST OF CURRENT FOR 1 MONTH WITH THIS LAMP 3 HOURS FOR 30 NIGHTS
29¢
NOTE THE BETTER QUALITY OF MAZDA LIGHT

Another machine represents "The Weighing of Carbons and Mazdas." One scale pan of a balance contains three carbon lamps and the other, one mazda lamp. The pans are automatically kept tilting and the pointer, moving to right or left indicates either the word "waste" or "economy" depending on whether the carbon or the mazda pan is down. By a further automatic arrangement, sixteen pieces of advertising copy also appear in consecutive order.

New Books

Elevators, Electric & Hydraulic—By C. F. Swingle, M.E., F. J. Drake & Company, publishers. Price $1 net. Literature treating upon the subject of elevators, either electric or hydraulic, is very rare. This volume has been prepared, therefore, with a view to assisting the engineer who is responsible for their care and the operators whose duty it is to handle elevators. The principles involved in the construction and operation of the various types of elevators are clearly set forth. The illustrations are such as to assist greatly in the understanding of the text and in making the operation of elevators evident to the untechnical reader.

Self-contained Motors—Pamphlet No. 16B issued by Bruce, Peebles & Company, Limited, on the subject of self-contained polyphase induction motors. The pamphlet contains a very full specification of the motors together with illustrations of various parts and of some of the different types of motor. In addition, outline illustrations and full lists of approximate weights and dimensions of every size manufactured by this company are given, as well as full lists of technical data for 50 and 25-cycle motors, machines being dealt with for three separate ranges of voltage from 110 volts up to 3,500 volts at speeds from 150 up to 1,500 r.p.m.

Transmission Line Formulae—By H. B. Dwight, B.Sc., Associate A. I. E. E.; D. Van Nostrand Company, publishers. Price $2 net. The object of this book is to compile a set of instructions for engineers which will enable them to make electrical calculations for transmission lines with the least possible amount of work. The chart and working formulae have for the most part been developed independently by the author. The second part of the book is for reference chiefly and contains the derivation of the principal formulae used in connection with transmission lines. It is stated in the preface that as many recent articles on transmission lines make use of formulae which are only roughly approximate, a reliable collection of formulae with the method of obtaining them should be found valuable.

Electric Meters—By Cyril M. Jansky, B.S., B.A., associate professor electrical engineering, University of Wisconsin. The McGraw Hill Book Company, New York, publishers. Price $2.50 net. This is a book which treats, in a comprehensive and systematic way, the various kinds of electrical measuring instruments. The descriptions apply chiefly to instruments manufactured in the United States. In the classification of these instruments the main divisions have been made in accordance with the quantities to be measured and minor sub-divisions according to the principles of operation. Although such a classification has necessitated some repetition in describing the different instruments whose operation is based on the same principles, still, for the sake of clearness and simplicity, such a classification appears justifiable. A successful attempt has been made to explain the fundamental principles in a general way and for this reason many line drawings and vector diagrams are used. The manner in which these fundamental principles are applied in practice is usually exemplified by means of cuts of the actual instruments. The book is splendidly printed and illustrated throughout and we believe, constitutes the best treatment of the subject of electric measuring instruments that has appeared to date.

The Dealer and Contractor

The Electrical Contractor as a Credit Risk

Opinions on the subject of the standing of electrical contractors and their value as credit risks, have been solicited by the National Electrical Contractor and the following notes by Mr. R. G. Littler, we believe, covers the situation as very generally existing. Mr. Littler's remarks bear out the statements recently made in the Electrical News regarding the necessity that electrical contractors pay more attention to the business end of their system and especially to that of the all-important overhead expense.

The subject of this discussion is one requiring a great deal of careful thought if it is to bring out suggestions which will be of benefit to our readers, and to all those interested in placing the electrical contractor on a basis where he really would be considered a good credit risk.

The first point which comes to the mind of the writer is: The reason or reasons why, the electrical contractor (generally speaking), is considered a poor risk and slow in paying his accounts. In the first place, let us follow the "rosy" path of the "average" contractor, from the time he begins business, until he is either swamped by a land-slide of creditors, or else becomes, in a measure, a responsible business man, looked upon as really desirable by those from whom he does most of his purchasing. In the former class, statistics tell us that approximately 95 per cent. of electrical contractors are listed, leaving the magnificent balance of 5 per cent. as fairly successful in the line of business which they have selected as a livelihood.

In tracing the foot steps of the average contractor from his birth into the business world, to his untimely death or ultimate success, I would proceed about as follows:

We have a journeyman wireman, and very frequently a budding apprentice, working for an apparently well-to-do contracting firm, probably for several years, and giving good and satisfactory service in return for his salary. He is probably living in the city suburbs, and a friend or neighbor is building one or more houses and takes the liberty of having the electrician next door give him a figure for wiring the houses. The electrician is finally permitted to wire the said houses during the evening when he has nothing else to do, probably having his regular helper assist him, after agreeing to pay him for his time at the regular wage scale.

He goes to the jobbing house where he has been in the habit of getting materials, probably every day for his employers, and puts the matter up to the manager, reminds him that he has been working for the Blank Elec. Co. for four years or so, and shows him that he is going to make $25.00 or $50.00 on the wiring of the houses, with the result that he easily gets credit for the materials until his neighbor pays for the work. He then proceeds to wire the houses, which he does in about one half the time that would have been consumed if he were doing the work for Blank & Co. and is finally paid for his work.

After settling up with his helper, and also with the jobbing house, he finds that he has made probably $30.00 by working four or five evenings in the week. He then sees how foolish he has been all these years, working for the other firm and thinks it is clear sailing. He goes to the jobber and arranges for further credit, (which, by the way), is the easiest part of the game and starts out bidding on all jobs which are within his ability to handle. He finally succeeds in landing several houses, probably a small apartment house or two, etc.

He then sees the business getting so large that he can no longer do all the work himself, and he hires three or four men, rents a shop and goes at things, as he thinks, in a business-like manner.

From this time on the overhead expenses of the business are piling up, unseen by the new proprietor, who only realizes the accounts due him and does not take the trouble to realize the amounts he owes for supplies. In the course of time, his jobbing house sends for him and begins to inquire about the over due statements they have been sending. He successfully puts them off, however, until he makes "some collections" which seems to satisfy the jobber for the time being. The collections are finally made and the jobber gets probably 25 or 50 per cent. settlement, and the balance of the money collected goes into an automobile or some other equally valuable business asset.

Debts in Many Places

About this time, the contractor begins to patronize other jobbing houses, who are glad to receive a portion of his business, thinking they are putting one over on the original jobber. Things then go from bad to worse, the contractor becomes indebted to every jobber in town until finally some house files an attachment against his contracts and ties up his bank account (if he has one) and the thing is all over but the shouting. In the average case, the creditors get from 10 to 25 cents on the dollar, this particular contractor is no more, and the next contractor steps up to the bat, and the same thing happens all over again.

I have now dragged the contractor through the mire, and threshed the life out of him from every standpoint, but he is not entirely responsible, by any means for his downfall.

The jobber or jobbers who have been selling this man his materials have contributed considerably toward his destruction by being too lenient with him in the way of extending credit. The promiscuous giving of credit among jobbing houses which is nothing more or less than financing of contractors, is undoubtedly the cause of a great many failures in the contracting business.

Competition between the jobbers has become so keen that they are ready and willing to take a chance on a man and to finance his schemes, for fear that they will lose an account to a competitor, that may at some time in the future, be a valuable one. They probably start out by requiring the prospective contractor to pay cash for his purchases, which process finally results in the giving of credit to a certain limit, and this limit is gradually extended until the account grows to a dangerous size. It is this ease of being able to purchase materials on credit which enables so many to make a start into the electrical contracting game, and it is the lack of credit information among the jobbers that causes the loss of so many accounts. Cases are not infrequent where as many as six or eight jobbing houses have filed claims on the failure of a single firm. This would be entirely uncalled for if the jobbers would forget their petty jealousies and have some medium of credit information among themselves. They should thoroughly investigate every new contractor who goes into business, as to his ability, honesty, previous record, etc., but the watchfulness should not stop at that point. The contractor should be watched as to how promptly he settles his bills, the class of contracts he takes, the economy he practices in his business and every day life, and such information should be made general property among the jobbers in the locality in which the contractor is doing business. The results of such an investigation and information would doubly repay those taking the trouble to make investigation, and would in time mean the establishment of a system which would be a widespread protection to the jobbing interests as well as to the contractors who are trying to run a legitimate business, and to those who are having contracting work done.

One of the best safeguards for the protection of the contracting interests, and which would mutually protect all those with whom the contractor deals, including the general public, is the Master Electricians License Law, such as has been passed in some of the States and has proved a great benefit to all concerned. This law, in a great measure, guarantees the fitness of an applicant for a State License to do electrical contracting, and makes him also more responsible financially than any thing could do under the present methods. Almost all states require the examination of barbers, plumbers, dentists, physicians, etc., and still allow any man who desires, to enter in to the electrical business, without the accounting to the State, as to his ability to perform the work whatever.

We have, now, as suggestions to make the Electrical Contractor a better credit risk, the following:

Co-operation among the jobbers themselves, including the distribution of credit and other information as given above.

More careful investigation of a proposed contractor, making the securing of credit more important than the mere asking.

Requiring the more prompt payment of accounts without fear of a competitor getting the business.

Securing the passage and operation of a Model State License Law for Master Electricians.

The Booth Felt Co.

The Booth Felt Company, Limited, has been incorporated by Mr. N. E. Booth, of Brooklyn, N.Y., to operate in Gananoque, Ontario. This company has acquired the Gibson property on Tanner street, Gananoque, and the plant is being put in shape for manufacturing a most complete line of felt goods for all mechanical and commercial uses. It covers felt washers, packings, lubricating pads, all kinds of dust and weather proofing strips, insulating materials, noise preventing typewriter pads, felt heel pads for shoes, wicks for fan motors and machinery, buffing and polishing wheels, hand blocks for rubbing and polishing, discs for electric light bulbs and many other specialties in the line of felt for manufacturers of machinery and mechanical appliances of every description. We understand the machines for this particular line of work have all been designed by and built specially for Mr. Booth.

The directors of the company are N. E. Booth, Brooklyn, N.Y.; E. W. Booth, Brooklyn, N.Y.; E. S. Sheppard, Gananoque, Ont.; B. A. Booth, Gananoque, Ont., and T. R. Brawley, Brooklyn, N.Y. Mr. E. S. Sheppard is secretary and general manager of the Canadian company.

The Largest D. C. Generators

The illustrations herewith represent what is claimed to be the largest capacity direct current generators ever built. They have just been installed in the plant of the Cleveland Electric Illuminating Company, and were manufactured by the Westinghouse Electric & Manufacturing Company.

These are two 3,750 kw., 275 volt, 180 r.p.m. shunt wound direct current generators driven by steam turbines through reduction gears with a 10 to 1 ratio. Fig. 1, taken while the machines were on test in the works, shows a workman of slightly above the average height in the foreground and gives one some idea of the dimensions of the machine. Each of these generators, entirely exclusive of the turbine and reduction gear, make six carloads during transportation. The armature was shipped on a flat car with the platform removed. The windings of the armature extended down to within four inches of the ballast on the railroad track. A sheet steel plate ⅜ inch thick, was placed beneath the armature to protect it from stones or any other projection on the road bed. Even with the armature at this level, there was only one routing between East Pittsburgh and Cleveland where the clearance was sufficient to permit the armature to pass.

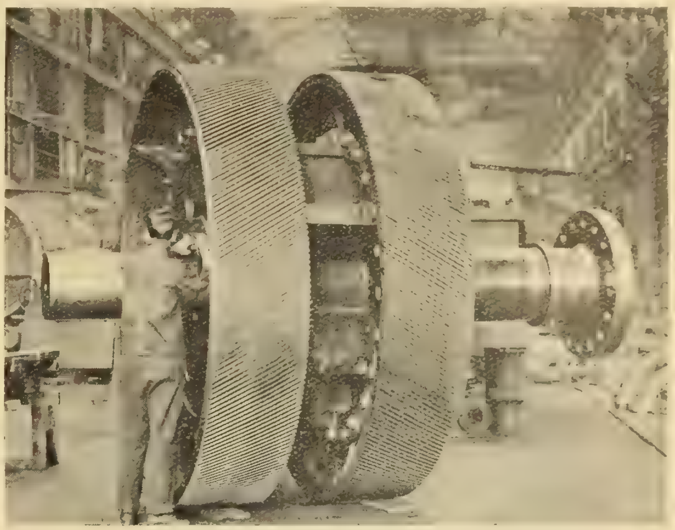


Fig. 1

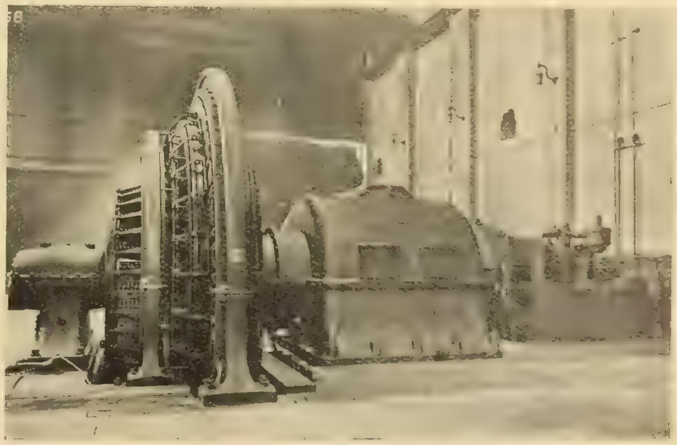


Fig. 2

As it was impossible in the present state of the art to build a direct current generator of this size for a high speed, use has been made of the reduction gear which has achieved such an excellent reputation in marine work and is now being extensively used in connection with d.c. generators and steam turbines. The large gear of this speed reducing mechanism shown in Fig. 2 is 8 ft. 4 in. in diameter and has 259 teeth. The pinion has twenty-six teeth, and the ratio of 26 to 259 gives the "hunting-tooth" feature which has been recognized as desirable in the design of toothed gearing. The speed of this gear at the pitch line is approximately 54 miles an hour. At full rated load of the generator the gear transmits 5,350 brake h.p., and on several occasions during overloads it has carried 6,000 brake h.p. without giving any indication that its ultimate safe output had been reached.

Portable Electric Grinders

The illustrations herewith represent a handy line of portable electric grinders just placed on the Canadian market by the Van Dorn & Dutton Company, through their agent, R. E. T. Pringle, Toronto. These grinders are a natural sequence to the economical and successful results obtained from the same company's electrically operated drilling and reaming machines and we understand they represent the same high standard of quality. The company states that these grinders represent the result of years of specializing in portable electrically operated tools and have been subjected to a most thorough test under varying and exacting conditions before being placed on the market.

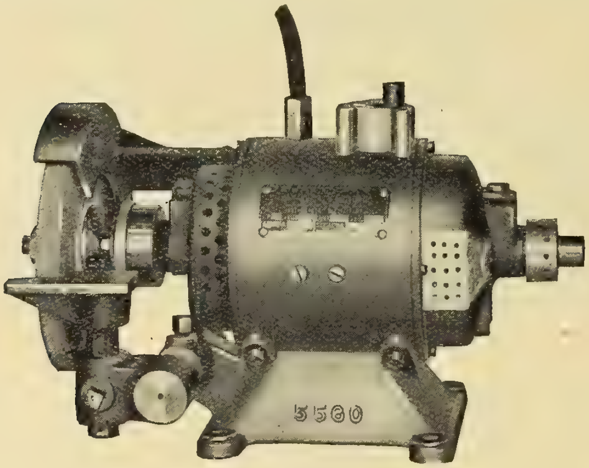


Fig. 1

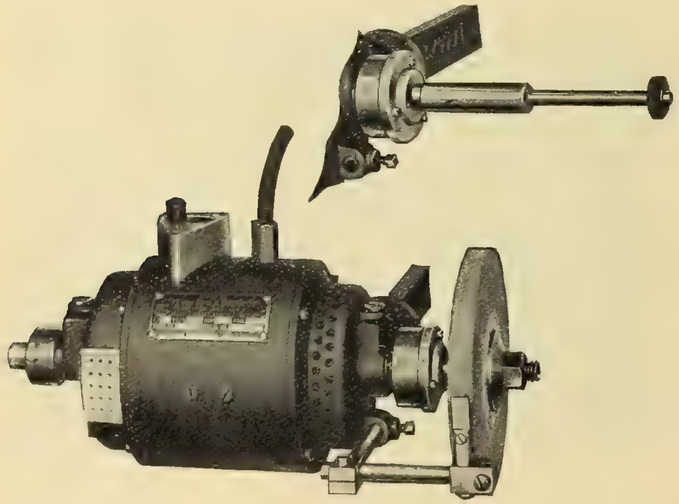


Fig. 2

The grinders are constructed by the most approved methods and represent the best mechanical and electrical practice. All parts are gauged and made accurate to micrometer dimensions which insures perfect interchangeability. The motor is form wound. The pole pieces are of Swedish steel and the motor shell of a special magnetic steel. A special process of insulation has been employed. Commutator is made from the best grades of drawn copper and soft silver amber mica. The brush holders are located on a fibre insulated base fastened to the head and are easy of access for inspection, cleaning or replacement. The wheel and bearings are of best grade phosphor bronze tapered. The thrust end bearings are finely adjustable. The journals are ground, producing a smooth wearing surface. Lubrication is by oil chambers cast integral with the motor housing. Cooling is by ventilation fan. Each machine is equipped with a cable of sufficient length and fuse plug for a connection to a socket. Any ordinary electric light socket may be used. The handles on all aerial types are adjustable and may be placed in any position to meet all conditions.

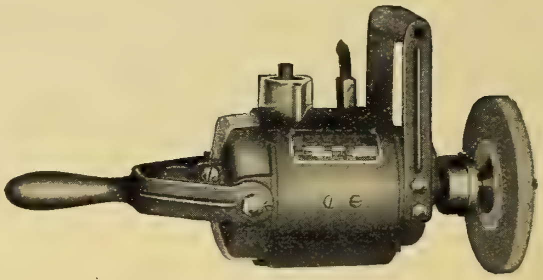


Fig. 3

Fig. 1 represents a bench type suitable for grinding small tools or other general foundry, machine shop or boiler shop grinding; also used for buffing and polishing. Fig. 2 represents a tool post grinder. It is calculated for internal and external grinding on laths, tool grinding or milling machine and surface grinder on planer and shaper; furnished with internal grinding attachment as shown. Fig. 3, representing an aerial type, with handles, is for general grinding, buffing and polishing. Fig. 4 is an aerial type with 12-in. extension used for general grinding where work is to be dressed inside. This type can also be used for buffing and polishing.

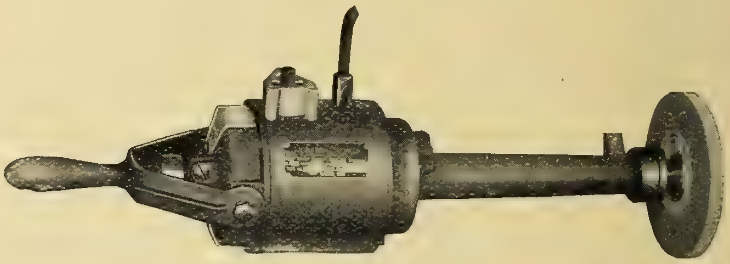


Fig. 4

The Line Material Co.

Announcement is made that the Ajax Line Material Works, at South Milwaukee, Wis., will be known in future as the Line Material Company. A new president, Mr. F. L. Sivyer, has been elected, who is also president of the North Western Malleable Iron Company and the Sivyer Steel Casting Company. The Line Material Company is engaged in the manufacture of all kinds of line material, such as brackets, street hoods, tungsten fixtures, self-locking windlasses, hangers, mast arms, ornamental lighting posts, malleable iron posts, bolts, washers, etc. A new galvanizing plant has also just been installed.

The Twenty-fourth Annual Convention of the Canadian Association of Stationary Engineers will be held at Owen Sound Ontario, July 29th, 30th and 31st. There will be an exhibit in connection with the Exhibition.

The Fusette Fuse Plug

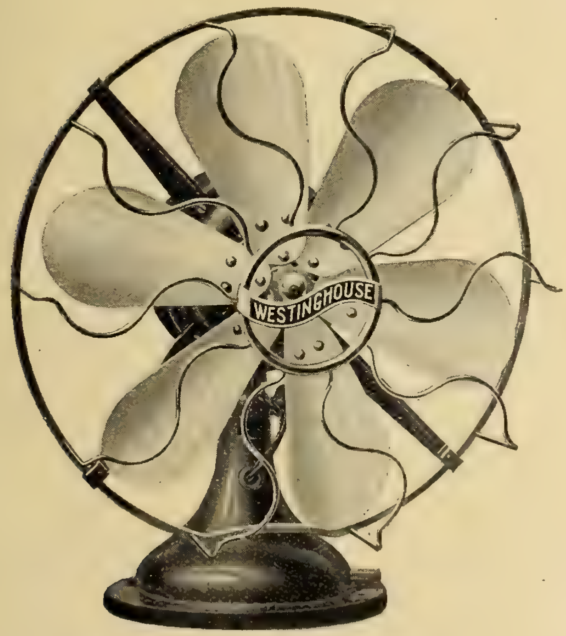
A long felt want is being handled by the Canadian General Electric Company, Limited, in the shape of a removable fuse plug, also called Fusette fuse plug. This fusette fuse plug is made up in two parts, the holder and the plug, or fusette, and only the latter requires renewing should the fuse blow. The holder is of the regular fuse plug design, with permanent metal cap and mica lining. It has a permanent inside brass sleeve with the necessary screw threads for fastening into a cutout. The fusette consists of a hollow piece of porcelain with a fuse mounted inside, and is so shaped as to fit into the brass sleeve of the holder. Fusettes are made in sizes of from 3 to 30 amperes. The holder and fusette make up the complete fuse plug. This little device will, we believe, prove a great convenience and money saver. The accompanying illustration explains the workings of the device.

Fusette holder

Fusette

6-blade, 16 inch Fan

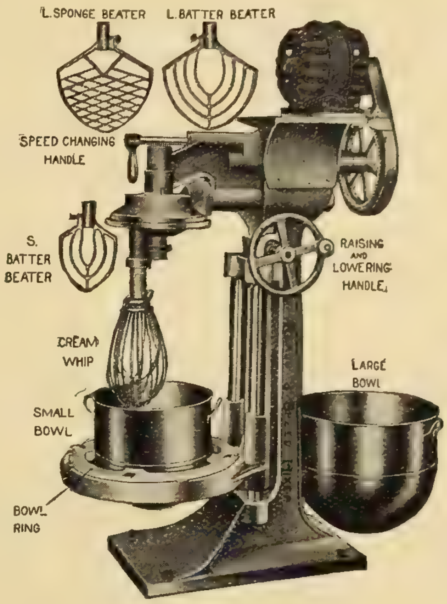
The drawn steel fan, introduced last year by the Westinghouse Electric & Manufacturing Company, and which proved so popular, has been continued this year. The quiet running six-blade type of fan has been extended to include the 16 in. size, see illustration herewith, and also the oscillating type of fan. There has also been added an induction motor type of 8 in. fan. The six-blade fan, because of its slow speed is extremely quiet in operation and for this reason is particularly adapted for places where quietness is essential, such as libraries, reading rooms, hospitals, etc. The drawn steel frame of the desk and bracket and oscillating fans furnish a smooth surface, and is extremely pleasing with any finish. These fans can be mounted either on a horizontal surface or on the wall, the change being made without the use of any tools, and can be tilted or rotated in any position desired.



Motor Driven Mixer and Beater

The use of machines driven by small individual electric motors has proved a great source of economy in bakeries, confectionery plants, hotels, and restaurants. These machines do their work much more rapidly than it can be done by hand, and produce better and more uniform results at an insignificant expense of current. Hence the cost of labor is greatly reduced; the work can be put through with less delays, and working conditions in the kitchen or bakery are greatly improved by reducing the number of people employed in it and lessening the amount of material standing around and spilled.

Motor-driven machines of all kinds can be obtained; egg and cake beaters, dough mixers, dish washers, knife grinders, silverware polishers, vegetable parers, fruit pitters, etc. The beater and mixer illustrated herewith is a typical example of these time and labor saving devices, and gives an excellent idea of what can be accomplished by them. This machine is applicable to all classes of plain and fancy cake, biscuit, and egg work, fruit and other pie fillers, jams, jellies, sauces, dressings and other preparations that require mixing and mashing.



The beating bowl rests on a stand which can be raised to the beater by turning a handle. When one operation is completed, the bowl is lowered and another substituted. A variety of styles and sizes of paddles, such as beaters for sponge, batter, eggs, cream, fruit, pumpkin, cheese cakes, and potatoes can be supplied for the machine; and, since one can be quickly replaced by another, the operation of the machine can be made practically continuous regardless of the kind of work to be done.

These machines are made by the Read Machinery Company, York, Pa., and Westinghouse motors are used to drive them. The motor has three speeds, any one of which can be obtained by turning a handle without stopping the machine. The capacities of the bowls which are supplied with the machine are 30 and 80 quarts. Where the mixture to be beaten must be kept hot or ice cold, a water bath is supplied.

Benjamin Products—The Benjamin Electric Manufacturing Company of Canada, Limited, are distributing their new catalogue C 21, which includes many new products and is a complete reference book for wiring devices, etc.

Current News and Notes

Aylmer, Que.

The town contemplates installing a complete electric lighting system at an estimated cost of $30,000.

Berlin, Ont.

It is now said that the Berlin & Northern Railway Company will not likely extend to Wellesley on account of difficulties in connection with an entrance to Stratford.

The Hydro-electric Power Commission of Ontario has placed the cost of street lighting for the current year at $16,000. This is a reduction from last year's figure although more lights will be in use.

The Berlin & Northern Railway Company, following a request to extend their line from Bridgeport to West Montrose and Conestogo, have requested assistance, including bond guarantee and bonus of $18,000 per mile. Mr. W. H. Breithaupt is president of this road and is carrying on the negotiations.

It is expected that the power load in this city will amount to 1,300 h.p. during the present year. The Light Commissioners are taking the matter of additional sub-station equipment up with the Hydro-electric Power Commission.

Brantford, Ont.

It is said that residents of a number of districts suburban to this city have petitioned for the installation of hydro-electric power and light.

Barrie, Ont.

Anticipating the advent of hydro-electric power from the Severn river, it is proposed to do away with the arc lighting system along the principal streets and substitute some 500 tungsten incandescents. These would probably be suspended from arms attached to poles already on the streets.

Calgary, Alta.

Net earnings of the Calgary Power Company for the year ending December 31st, 1912, amounted to $151,707. The estimated net earnings for 1913 is $270,000. The directors of the company are,—president, R. B. Bennett, K.C., M.P.; vice-president, H. S. Holt; E. R. Wood, Sir W. M. Aitken, R. T. D. Aitken, A. E. Cross, W. H. Hogg, F. P. Jones, H. A. Lovett.

During the past month the new 1,000 kw. railway generator in Calgary has been tested out on over-loads of 25 to 50 per cent. and is reported to be giving excellent satisfaction. A new 500 kw. Dick-Kerr railway motor-generator has also been put in service at the Ogden sub-station. The 1,000 kw. unit is of the Swedish General Electric Company, auto-synchronous type.

Cannington, Ont.

On April 15th, a by-law will be voted on to raise $12,000 by debentures for a hydro-electric distribution plant.

Edmonton, Alta.

The Northern Electric and Manufacturing Company has received a contract for 257,500 feet of steel wire for the municipal telephone department.

The council approved the plans to lay 10 miles more of railway. (1) From Highlands to Beverly Heights; (2) Up First street to Alberta avenue; (3) From Whyte avenue to 19th avenue south along 7th street east and along 19th to 10th or 12th street then up either of these streets. The property owners by which this railway passes are bearing the expense.

The city council have approved the principle of extensions to a number of suburban properties outside the city limits, the lines to be built by the property holders interested and their cost of operation guaranteed for a limited time, probably two years.

It is reported to be the intention of the Grand Trunk Pacific railway system to install telephone lines from Edmonton through to the Pacific coast, both for the operation of trains and the handling of commercial messages.

Ft. William, Ont.

It is reported that the Canadian Car & Foundry Company will install producer gas electric units to a total capacity of 3600 kw.

It is announced that the first work of the construction department will be to build the Island No. 2 extension to the street railway system. This is claimed to be most important in view of several new industries likely to locate there.

Goderich, Ont.

The Ontario West Shore railway on which considerable money has been expended by Mr. Jno. W. Moyes and his associates, may fall into the hands of the municipalities along the line. The latter have guaranteed the bonds of the company to the extent of $400,000.

Hamilton, Ont.

Contracts have been awarded for an electric pumping station to Geo. E. Mills, 614 King street east.

The Cataract Light & Power Company has announced a reduction of 25 per cent. in its commercial lighting rates.

Hanover, Ont.

The Hanover Electric Light & Power Company, Hanover, Ontario, expect to install meters shortly. In the past they have operated on the flat rate.

Halifax, N.S.

At a recent hearing before the railway and municipal committee of the legislature, Mr. E. A. Robert, president of the Halifax electric tramway system, made a strong argument against the proposed action of the city to expropriate the property of this company. Mr. Robert pointed out that an agreement between the city and the corporation should be as binding as between two individuals. He is also reported to have stated further, that the agitation for municipal ownership of this line rested primarily with Senator Dennis, who, with Mr. Lorne McGibbon, of Montreal, was anxious to secure control of the railway that they may urge extensions to exploit real estate properties recently purchased by them in the outskirts of Halifax.

Islington, Ont.

The franchise of the Toronto and York Radial Railway Company for the operation of their cars on the Lake Shore Road expired in January, 1912. As no new agreement has been made, and as the township did not show any inclination to take over the system, the Radial Company are now said to claim a perpetual franchise.

Kenogami, P.Q.

The second paper unit of Price Brothers & Company's new mill at Kenogami has started operation, thus bringing the capacity of the plant up to 100 tons per day. It is expected that the third unit of 50 tons daily capacity will be in operation within six weeks.

Kenora, Ont.

Motor driven pumps in connection with the water supply department having a total capacity of 3,000 gals. per minute against a pressure of 70 lbs. will be installed here at an early date. The pumps will operate ordinarily in multiple, but in cases of fire will work in series giving 1,500 gallons per minute against a pressure of 140 lbs.

Kamloops, B.C.

Contract has been awarded for the construction of the power station building to Johnson & Company.

London, Ont.

Two new 500 h.p. steam turbine engines, generators and electrical equipment may be required shortly by the London Electric Company.

Manager Warburton, of the London & Lake Erie Transportation Company, is reported to have stated that he finds hydro-electric power more expensive than the old steam system. It is said that reductions in rate looked for by the railway company have not yet been forthcoming.

Work on the construction of the north end street railway lines is being carried on vigorously.

Merlin, Ont.

Estimates are to be secured for installing a new electric power plant for the town.

Medicine Hat, Alta.

It is said the contract for the building of a street railway in Medicine Hat has been signed by Sir Max Aitken representing the company, and that work will be commenced as soon as this agreement can be ratified by the ratepayers.

Moose Jaw, Sask.

The corporation of the city of Moose Jaw have just placed an order with the Siemens Company of Canada for a 1500 kw. turbo-generator. This machine will be 3600 r.p.m., 3-phase, 60-cycle type, direct-connected to a Willans & Robinson steam turbine.

Macleod, Alta.

The Electric Light Department report a surplus for the year 1912 of approximately $4,500.

Montreal, Que.

The plans and specifications for the underground conduit system to St. Catherine street, Montreal, are now ready for contractors to tender on the work. The plans and specifications have been prepared by the Electrical Service Commission, which is also preparing plans for other streets. The tenders will have to be in on April 25th, and must be for the whole of the work.

There is evidence that the City of Montreal and the Tramways Company are getting closer together with a view to improving and extending the service. The president of the company announces that a plan will be submitted with this end in view, and the council also desire time to study the reports of three experts who have examined the situation. It is proposed to eliminate some of the stops, Mr. J. E. Hutcheson, the manager of the company, favouring a stop every 600 to 700 feet.

The directors of the Montreal Tramways Company have declared an interim dividend of 5 per cent. on the capital stock, and announce that a new issue of $1,000,000 at par will be made. This is the first dividend under the scheme of reorganization adopted in 1911.

It is officially announced that the following programme of telegraph construction will be carried out during the year by the Grand Trunk Pacific Company—a line will be erected from Harte, Man., to Brandon, while the Regina and International Boundary line, the Regina-Moose Jaw branch line, the Young-Prince Albert branch line, will be completed, as also a Battleford section through the Cut Knife district, an extension from Biggar, and the Tofield-Calgary line. The main line between Tete Jaune Cache and the Shuswap River, B.C., is being built and construction work carried on at New Hazelton, and the end of steel.

The National Hydro-Electric Power Company, who propose developing the Carillon Falls, have just put in operation the first unit of 250 h.p. Work is proceeding on the second unit of similar size, and these will be ultimately used in the construction of the large plant which it is proposed to erect. The plans for the latter are well under way. The small quantity of power now being generated will in the meantime be sold to local buyers.

The Montreal Jovian Club has been formed and the upper floor of Copper's Restaurant has been engaged for a permanent meeting place. The club will be opened this month, and it is also proposed to hold weekly luncheons. Another rejuvenation will be held during April.

The Canadian Car & Foundry Company, Montreal, propose to install in their new plant which is now being constructed in Fort William, Ont., gas-producer electrical equipment to the extent of 2500 kw. The company have purchased the gas-producer equipment from the R. D. Wood Company, Philadelphia; the gas engine from the Mesta Machine Company, Pittsburg, and the generator, alternating current, from the Allis-Chalmers-Bullock Company.

Mr. D. E. Morkill, of the Grand Trunk Railway Signal Department read a paper on "Train Despatching by Electrical Methods" for the members of the Montreal Electrical Society, on April 4th. Mr. Morkill described the different systems used by the railway companies, referring in particular to the staff system. Mr. P. T. Davies presided.

Nelson, B.C.

The annual report covering the operations of the street railway system of the year 1912 show that there is still a small deficit to be overcome. Operations for the first two months of the present year indicate that profits will be considerably greater in 1913.

Owen Sound, Ont.

The Hydro-electric Power Commission of Ontario offered this town 1500 h.p. on a $29 rate. As the feeling is against contracting for such a large amount, a quotation on 800 h.p. is now asked.

Ottawa, Ont.

About a dozen underground new mains are to be laid by the Ottawa Municipal electric lighting plant for the purpose of supplying new customers.

The town of Eastview contemplate a new street lighting system. C. Gladu, McArthur road, is mayor.

To relieve the street car congestion on Sparks street the Ottawa Electric Railway Company are going to lay a single track on Queen street as soon as the weather permits. The extension of the double track Bank street line from the exhibition grounds to Billings Bridge in Ottawa south, a distance of about one mile, will be under way early next month. As soon as the extension is completed 20 new double truck cars are to be put into service.

An agitation is being started by Controller Hinchey for the establishing of a municipal gas plant in Ottawa. Information as to the feasibility and wisdom of such an undertaking is now under serious consideration.

Ornamental standards, cast iron, with 5-cluster lights are contemplated in Somerset street. Length of proposed system about 2 miles.

Contracts have been awarded as follows,—tape, solder, motor, incandescent lamps to Garrioch, Godard & Co.; copper wire, split knobs, carbons, arc lamp globes, transformers to Canada General Electric Company; insulators, top-pins, Northern Electric & Manufacturing Company; meters, Ferranti Electrical Company.

Evidence will be taken before the Ontario Railway and Municipal Board on the value of Chats Falls, on April 29th. This power is being expropriated for development purposes by the Hydro-electric Power Commission of Ontario.

Mr. V. Gandil, a director of the Universal Radio Syndicate, Limited, London, Eng., has been on a visit to Ottawa with a view to getting the Federal authorities to approve of the establishment of a direct wireless system between Great Britain and Canada.

Prince Albert, Sask.

The telephone department has purchased the material for the new telephone building here and the work of erection will begin immediately according to a statement of the Provincial Minister of Public Works.

Port Arthur, Ont.

Tenders will be received by Commissioner J. J. Hackney, until April 21st for 600 4-pin cross arms, 600 6-pin cross arms, 400 10-pin cross arms, 6,000 top pins (locust or birch), 2,400 cross arm braces(galvanized), 6,000 pole steps, ⅝ by 10 in. (galvanized), 6,000 glass insulators, D.G.D.P., 400 strain insulators, 5,000 No. 4 porcelain knobs. Tenders have also been called for 12,000 ft. of 400-pair cable, 25-25 pairs cantop cable terminals with cable, 30-15 pairs cantops with cable, 25-10 pairs cantops with cable, 500 protectors, 10,000 paper sleeves, 800 lbs. lead sleeving, 8,700 ft. of 4 multiple clay conduit, 600 lbs. wiping solder (easy wiping).

Also received by commissioner until April 21st for 100,000 ft. of style "B" wire No. 18, 20,000 ft. of style "C" wire No. 20, 20,000 ft. of pot head wire No. 22, 4,000 lbs. messenger wire, 1,000 lbs. guy wire. 6 tons No. 2/0 stranded D. B. W. P. wire, 6 tons No. 1/0 stranded D. B. W. P. wire, 5 tons No. 6 solid D. B. W. P. wire, 2 tons No. 10 solid D. B. W. P. wire, 1 ton No. 12 solid D. B. W. P. wire.

Regina, Sask.

Plans are being prepared by the Provincial Government Department of Railways, Telegraphs and Telephones for about 1½ miles of telephone conduit and 1½ miles of trenching 6 ft. deep.

Ridgeway, Ont.

Fire destroyed the exchange of the Bell Telephone Company here recently.

Stayner, Ont.

The Stayner Electric Light Company have sold their plant to the town, and hydro-electric power will be purchased from the Hydro-electric Power Commission of Ontario. This town is on the line fed from the Severn river.

St. John, N.B.

Following objections from numerous quarters the matter of the erection of a dam on the St. John river by the St. John Hydro-electric Power Company will be considered by the International St. John River Commission. It is understood the plans of the company call for a dam across the St. John river at a point about 40 miles above Fredericton, the dam to be 25 ft. high. Lumber interests and fishing interests have both opposed the proposition and now it is stated that the work would be contrary to a treaty existing between the United States and Great Britain which provides that the navigation of the St. John river shall be clear and unobstructed to the citizens of both countries from its source to its mouth.

Swift Current, Sask.

The contemplated addition to the power house and electric light plant is estimated to cost $100,000.

Sherbrooke, P.Q.

A judgment of interest was recently rendered by Mr. Justice Hutchinson in connection with the rights of a street car on the streets of a city. The action followed a rear collision with a milk wagon, the owner of the wagon making claim for damages. It was contended by the railway company that the gong was sounded and ample time given the driver to get out of the way, but Justice Hutchinson, in allowing the milkman's claim, states that a railway company has no right to run into and damage a citizen's vehicle. It is suggested however, that a driver, in blocking the passage of cars, may render himself liable to a fine and possibly to a claim for damages.

St. Thomas, Ont.

The St. Thomas city council has raised the price of fares on the municipal street railway system to 6 for 25c and 8 limited for 25c. In the past the tickets have been 8 and 10 for 25c for the same class.

Saskatoon, Sask.

The offer of a syndicate of several property owners to build an electric line between Sunderland and this city has been accepted. The syndicate agrees to construct the road according to the specifications of Electrical Superintendent Hanson, and then hand it over to the city free of cost. The city on their part agree to operate the railway, giving an hourly service between 6 a.m. and 12 p.m.

The p.a.y.e. system has been inaugurated on the municipal street car system here.

Toronto, Ont.

A contract has been awarded by the Hydro-electric Power Commission of Ontario to John Hayman & Sons, London, Ont., for the construction of a sub-station to be situated between Brantford and Paris. The station is a one-storey, 60 ft. x 80 ft., cement foundation, brick and structural steel construction, concrete and maple floors, felt and gravel roof, fireproof doors, wire glass windows, etc. The transformer equipment in this sub-station will be supplied by the Canadian Westinghouse Company of Hamilton.

By a vote of three to two, the Board of Control has sent on to council, a motion that it is inadvisable to lay civic car lines on the local improvement plan.

The New York State Public Service Commission has handed down an elaborate decision in the complaint against the electric rates charged by the private companies in Buffalo, N.Y., as recently investigated before expert evidence by that Commission. A reduction is ordered of 25 per cent. in the rates of both the private companies operating.

The Board of Control and the York Radial Railway Company are not yet able to agree on terms in connection with the proposal to double track upper Yonge street and allow a joint use of the tracks.

The four large electric pumps situated in the main pumping station at the foot of John street are now completed. These have a capacity of approximately 50,000,000 gallons and are sufficient to meet the requirements of the city under ordinary circumstances. The steam plant, however, will be kept as an auxiliary or for emergency.

By a recent act of the legislature, the city of Toronto will be allowed to operate cars on the municipal lines on Sunday.

The city has been notified that the application of the Toronto and Niagara Power Company for permission to construct its proposed transmission line along the Lake Shore road has been approved. It is understood, however, that the proviso is included that all wires following this course, owned by whatsoever company, must be strung on one single pole line.

The Bell Telephone Company has secured a permit for the erection of a $34,000 two-storey brick and steel telephone exchange near the corner of Bathurst street and Helena avenue.

Contracts have recently been awarded by the Ontario Hydro-electric Power Commission for extensions to their high tension transmission line from St. Thomas west to Windsor and a duplication of their present single-circuit line from Dundas to St. Thomas. The Canadian Westinghouse will supply the transformer and switching equipment required, which will probably be about 5,000 h.p. capacity in both Chatham and Windsor. In connection with the second line from Dundas to St. Thomas extensions will be made to the Dundas, St. Thomas and London sub-stations. The Canadian Westinghouse will also supply the switching equipment necessary for these extensions. Other successful tenderers were the Canadian Bridge Company, Walkerville, for steel towers and footings; the Canadian Porcelain Company for insulators; the Galt Malleable Iron Company for malleable clamps, and W. H. Dunne, Toronto, for pressed steel clamps.

Commissioner Harris has been given power to purchase car barn sites in connection with the operation of the St. Clair avenue municipal line. It is reported that tenders will probably be called for the necessary rolling stock and other equipments in the very near future.

The Toronto Electric Light Company have placed an order for the installation of a 7500 kw. steam turbo-generator. The installation will be completed about July 1st.

Owner, City Council. Tenders have been called for trolley wire, cable, suspensions, hangers, pull overs, sleeves, ears, frogs, bolts, bonds, etc., for St. Clair avenue.

Truro, N.S.

The Board of Commissioners of Public Utilities have taken evidence on the questions at issue between the town of Truro and the Chambers Electric Light & Power Company regarding the new schedule of rates proposed by the company which were to go into effect on April 1st.

Vernon, B.C.

Tenders were received up to April 11 by D. G. Tate, city clerk, for a ten ton hand-operated travelling crane. Mather, Yuill & Company are consulting engineers.

Vancouver, B.C.

The British Columbia Electric Railway Company has announced that reductions would be made in the charges for light in wards 7 and 8, beginning April 1st. It is also announced that the question of general reduction in rates throughout the city will be taken up by the company.

Weston, Ont.

Judge Morgan has handed down a decision in the matter of the legality of the election of Dr. Irwin and Mr. J. Cruikshank, as members of the water, fire and light committee. The election of these two members is voided on the ground that they are high school trustees, and, as such, are not eligible as members of the committee.

Windsor, Ont.

It is reported that an electric railway line will be built and operated on the Canadian side of the Detroit River between Amherstburg and Kingsville, this line to be operated by power from the Edison Company's system, Detroit, and owned by United States capital.

Winnipeg, Man.

Contract has been awarded to The Standard Underground Cable Company, Hamilton, Ont., for 30,000 ft. rubber covered cable for Light and Power Department.

The installation of the ornamental lighting system on North Main street will be proceeded with with as little delay as possible. The cost is estimated at $80,000.

Contract has been awarded to E. F. Phillips Electrical Works, Limited, for 42,500 lbs. No. 0 standard copper cable of medium hard drawn bare copper wire. Owner, Board of Control. Secretary, M. Peterson.

Tenders have been called by the Manitoba Government Telephone Department for the construction of about 1,000 miles of rural telephone line. Government supplies materials.

Owner, Board of Control. Council have passed a resolution for ornamental street lights on Colony street from Ellice avenue to Assiniboine River at an estimated cost of $7,500.

Welland, Ont.

Plans are in progress for an extension to the Welland Street Railway system.

Wiarton, Ont.

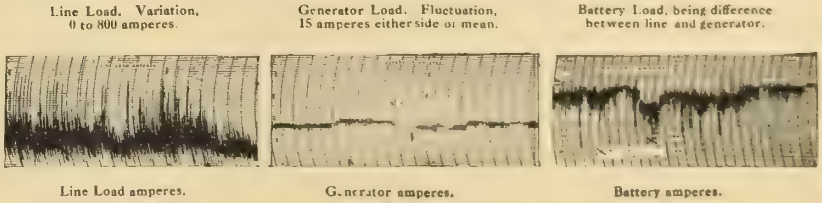
A by-law was passed on April 2nd, authorizing the issue of $6,500 debentures, part of which is being used to install new electric pumps.

The D-P STORAGE BATTERY

RESULTS of D-P BATTERY & AUTOMATIC REVERSIBLE BOOSTER INSTALLED IN A CENTRAL POWER STATION.

REASONS WHY A BATTERY IS INSTALLED IN EVERY UP-TO-DATE PLANT:

BECAUSE IT PROVIDES FOR A FLUCTUATING LOAD IT IS ESSENTIAL TO ECONOMICAL WORKING. INCREASED LOAD IS SUPPLIED WITHOUT ENLARGING GENERATING PLANT. IT NEVER FAILS SUDDENLY : : UNDER LOAD. IT MEETS EMERGENCIES



Canadian Agency: Messrs. O'LEARY & Co., Montreal, Vancouver, Winnipeg.

THE D-P BATTERY CO., LTD., Bakewell, England.

ESTABLISHED 1888. CODE: A B C, 5th EDITION. CONTRACTORS TO ADMIRALTY AND WAR OFFICE.

Toronto Hydro-Electric System

Second Annual Report of Toronto Electric Commissioners

Commissioners' Report

To His Worship the Mayor and the Members of the Council
of the Corporation of the City of Toronto:
Toronto.

Gentlemen,—

Your Commissioners beg to submit their Second Annual Report, accompanied by the Revenue Account and the Balance Sheet of the Toronto Hydro-Electric System for the year ended 31st December, 1912.

The accounts have been audited by John Mackay and Company, Chartered Accountants, Toronto, under the joint appointment of the Provincial Hydro-electric Commission and your Commissioners. Their certificate is appended to the accounts in question.

FINANCIAL POSITION AS AT 31ST DECEMBER, 1912:

The operations for the year 1912 have yielded satisfactory results. From the Revenue Account annexed hereto it will be observed that:

The gross income amounted to the sum of	$726,763.55
The cost of electric current and the expenses of operation and management, including repairs and maintenance, absorbed the sum of	500,564.26
Leaving a balance of net income of	$226,199.29
The interest chargeable against current operations for the year, sinking fund instalments for the year, and provision for the depreciation reserve fund, absorbed the sum of...	212,643.88
Leaving a balance of net surplus earnings for the year 1912, after meeting all charges applicable thereto, to carry forward to 1913 of	$ 13,555.41

It is to be especially noted that the expenses and charges generally described above, and which have been defrayed out of the year's income, include the total cost of getting business and promoting new business. The expenditure for advertising and for canvassers, etc., in prosecuting this important work amounted to over $53,000 for the year. In view of the volume of continuing business which has been procured as a result thereof, it would have been quite in accordance with commercial practice to carry forward as a charge against future profits a part of this expenditure. Your Commissioners, however, preferred to follow the conservative course of charging the total expenditure of the year against the income of the year.

The sinking fund accruing to the almost purely construction period ended 31st December, 1911, and which is carried as from that date as a charge against future profits, amounts as per the Balance Sheet to $50,985.49. The final result, therefore, of the operations for 1912 has been that of discharging in full the deficiency that accumulated during the earlier part of the year, when the revenue was smaller, and of accumulating a surplus of $13,555.41 to apply on the sinking fund obligations of the construction period, thus leaving only $37,430.08 of that obligation to carry forward against future earnings.

The net earnings are continuing to improve during the current year in a satisfactory ratio, and your Commissioners therefore feel warranted in stating that the surplus for the present year 1913 should, in their opinion, discharge the balance of sinking fund liability arising from the construction period, and leave a margin that will justify a reduction of rates in 1914.

The net result of the 1912 operations is more favorable than was anticipated from the interim approximate accounts prepared from time to time during the year. A very gratifying increase of business in the latter part of the year, together with the pleasing reduction of rates made by the Provincial Commission, a reduction in the rate of interest from that on which the interim accounts were based, and other matters, contributed to the ultimate satisfactory result.

It is perhaps worth noting that had the enterprise been conducted under share capital as an ordinary commercial corporation, instead of under debenture capital subject to repayment, the provision that has been made out of income for interest and sinking fund instalments, together with the surplus carried forward to next year (amounting to nearly $158,000) would have been available for dividend, and would have permitted the payment of a dividend at the rate of over 5 per cent. for the whole year on the average capital of $3,000,000 employed during the year. And this result has been effected on a scale of rates very much lower than the City and the Citizens had previously enjoyed, and on a volume of business that is still in the infancy stage of development.

The estimated cost of the completed plant as finally decided upon by your Commissioners was $4,500,000. Of this amount $3,734,911.33 has been expended to the end of 1912, leaving an unexpended balance against the completion of construction operations of $765,088.67. This sum will be sufficient to complete the work included in the $4,500,000 estimate.

The condition of the money market during the past year had the effect of leading your Commissioners to moderate the rate of construction progress, with the object of reducing their financial calls upon the Corporation.

CIVIC SERVICES:

Very satisfactory arrangements have been entered into with the Waterworks Department, which should prove of interest and value to the citizens in connection with the most important question of water supply. These arrangements cover the maintenance by the Waterworks Department of a complete steam pumping plant to be used by it during "Electric-Peak" hours, while, during "Off-Peak" hours electric power will be used. This insures to the Waterworks Department two sources of power supply, thereby protecting the citizens against the dangerous risks attendant upon a single source of supply, while at the same time it gives the Commission a substantial customer for "Off-Peak" periods. The

(Continued on Page 62)

Revenue Account of the City of Toronto Hydro-Electric System for Year Ended 31st December, 1912

Section 1—Showing Net Earnings from Total Operations for year

CHARGES

	Amount	Total
To cost of electric current	$ 194,328.19	
To expenses of operation and management, including repairs and maintenance; provision for special depreciation of leasehold buildings and improvements ($3,041); provision for actual and contingent losses on accounts receivable, and for all accrued charges as at 31st December, 1912......	306,236.07	
		$ 500,564.26
To balance—Profit carried forward to Section II.		226,199.29
		$ 726,763.55

INCOME

	Amount	Total
By Income From—		
Commercial lighting	$ 197,739.21	
Commercial power	94,400.05	
Municipal buildings	3,815.53	
Municipal power	106,619.38	
Municipal street lighting	275,666.23	
Exhibition light and power	22,032.35	
Other municipalities	2,399.77	
Sundry other sources	24,091.03	
		$ 726,763.55
		$ 726,763.55

Section 2—Showing Disposition of Net Earnings

	Amount	Total
To interest (one-half charged against construction accounts till 30th September..$	86,443.19	
To provision for depreciation	68,568.20	
To sinking fund instalments for year, including amount accrued at 31st December, 1912, and interest on past due instalments	57,632.49	
		212,643.88
To balance, representing surplus profits carried forward to 1913		13,555.41
		$ 226,199.29

	Total
By profit brought down from Section II..	$ 226,199 20
	$ 226,199.29

Balance Sheet as at 31st December, 1912, of the City of Toronto Hydro-Electric System

ASSETS

FIXED

	Amount	Total
To Capital Expenditure on—		
Lands, buildings, transmission system, sub-station equipment and feeder system, distribution system, municipal street lighting system, line transformers, meters, equipment and devices, general office stores department, utility department and miscellaneous equipment and Exhibition construction and equipment	$3,672,800.22	
Leasehold premises and improvements..	62,111.11	
		$3,734,911.33

LIQUID

	Amount	Total
To stores on hand	$ 254,003.55	
To accounts receivable (cash value)	314,733.13	
To cash on hand and in bank	4,904.13	
To prepaid charges	1,074.40	
To City Treasurer's suspense account ...	8,546.35	
		$ 583,261.56
To sinking fund suspense account—for amount of sinking fund instalments accrued during construction period and carried forward as a charge upon future profits	$ 50,985.49	
		$ 50,985.49
		$4,369,158.38

LIABILITIES

ON CURRENT ACCOUNT

	Amount	Total
By Sundry Accounts Payable—		
Including charges accrued to date .....$	433,287.30	
By Corporation of the City of Toronto—		
Interest to date, including $8,546.35, under adjustment	94,989.54	
		$ 528,276.84
By Sinking Fund—		
Instalments due and accrued to date to extinguish capital debt to Corporation of the City of Toronto by 1st July, 1948, the date on which the city debentures fall due	106,610.51	
Interest to date on past due instalments of sinking fund	2,007.47	
		$ 108,617.98
		$ 636,894.82

ON CAPITAL ACCOUNT

	Amount	Total
By Corporation of the City of Toronto—		
Advances under by-law No. 5,036, including interest capitalized thereunder ...	$2,539,005.60	
Advances under By-law No. 5,918, including interest capitalized thereunder ...	1,108,093.35	
		$3,647,098.95

ON SURPLUS ACCOUNT

	Amount	Total
By Depreciation Reserve Fund—		
In respect of general system, after providing out of income for repairs and maintenance of buildings, plant, and equipment... ... ...$	68,586.20	
In respect of leasehold buildings and improvements	3,041.00	
Total ... ...$	71,609.20	
By surplus Earnings for Year—		
After providing for expenses of operation, management and maintenance, for actual and contingent losses, and for interest, depreciation, and sinking funds	13,555.41	
		85,164.61
		$4,369,158.38

estimated cost to the Waterworks Department of maintaining under this combination the two sources of supply does not exceed the cost of maintaining the steam plant alone under the old arrangements. The Civic Street Car System is also being successfully operated with electric power furnished by the Commission.

GROWTH OF CITY AND ITS OBLIGATIONS:

Attention is drawn to the fact that the growth of the city will necessitate from time to time capital extensions to the Hydro-electric System. The mileage of the streets of the city was increased during 1912 from about 408 to 508 miles; the population is increasing; industrial activity shows no sign of abatement; and the services to the public which the Hydro-electric System was established to render must be adapted to the enlarging conditions and to the increasing demand that will arise therefrom. The undertaking as confirmed by the public at the time of the passage of the last By-law provided for 13,000 services, while at the present time nearly 17,000 services are established. While, however, these conditions will compel, from time to time, enlargements of the system, it is to be noted that the system as it stands today is capable of bearing the load of greatly increased demands from the public at large. Wherever Hydro lights are to be found in the streets, there is room and there are facilities for extending the service to the public.

GENERAL CONDITIONS:

That the work accomplished to date has been productive is sufficiently evidenced by the annexed accounts. It has not, however, been free from difficulties. On the contrary, your Commissioners have had to deal with serious and exacting administrative, construction ,and technical problems which have laid upon them an arduous burden of work. Nor is this work by any means finished. The potentialities of the system are very great. The development of a perfect, frictionless, and economical organization adapted to the increasing needs of the public and to the enlarging area of the city will always impose a burden of responsibility and concentrated work upon those to whom it is entrusted.

The final result of this venture into a new and wide field by Commission government under municipal auspices will also exert a great influence on the future limits of municipal enterprise. This additional responsibility is deeply felt. Your Commissioners have absolute confidence in the outcome.

For the confidence and the sympathetic support extended by the Prime Minister of the Province, Sir James Whitney, by the Provincial Hydro-electric Commission, by the Board of Trade and the Manufacturers' Association, by the press as a whole, and for the active support rendered by the municipal corporation of the City of Toronto, and by the citizens at large during the past year, they are deeply grateful. Such support and confidence can but stimulate them to further exertion in the work to which the city is now finally committed.

Respectfully submitted on behalf of the Commissioners,

P. W. ELLIS, H. C. HOCKEN.
Chairman. Mayor.

Toronto, Canada, 4th April, 1913.

GROWTH DURING 1912:

The growth in the services rendered the public during the year 1912 is striking, as the following table shows:

Particulars	At Jan 1, 1912	At Dec. 31 1912	Increase
Meters in use	3,901	13,858	9,957—255%
Lamps in use	87,270	300,024	212,754—244%
Street lanterns in use ...	18,800	33,824	15,024— 80%
Connected load, h.p.	10,811	54,655	43,844—405%
	Jan.	Dec.	
Peak load, h.p.	5,934	17,198	11,264—190%

AUDITOR'S REPORT

Toronto General Trusts Building,
85 Bay Street, Toronto, 3rd April, 1913.

The Toronto Electric Commissioners,
Toronto.

Gentlemen,—

We beg to annex hereto the Revenue Account for the year ended, and the Balance Sheet as at 31st December, 1912, of the Toronto Hydro-electric System. We have audited the books and accounts of the System from the 1st June, 1911—the date upon which you assumed control of the administration—to the 31st December, 1912. The expenditure upon the System from its inception until the 31st May, 1911, (during which time it was administered by the municipal corporation of the City of Toronto), amounting to approximately $1,400,000, has not been audited by us, and we therefore assume no responsibility in connection therewith. Subject to this reservation, we certify as follows:—

(1) No expenditure has been charged to Capital Account except such as is properly attributable thereto. That portion of the interest which constitutes an integral part of the cost of construction has been charged there against. By-law No. 5,918 of the City of Toronto authorizes the issue of $2,200,000 of debentures for the express purpose of providing, inter alia, for the said interest charge.

(2) The Income Account for the year has been charged not only with the usual expenses of operation and management, but with the whole of the cost of getting new business, no part of which has been carried forward; and with provision for actual and contingent losses, for special and general depreciation in addition to the cost of repairs and maintenance, for interest chargeable against current operations, and for the full requirements of the sinking fund necessary to extinguish the debt incurred.

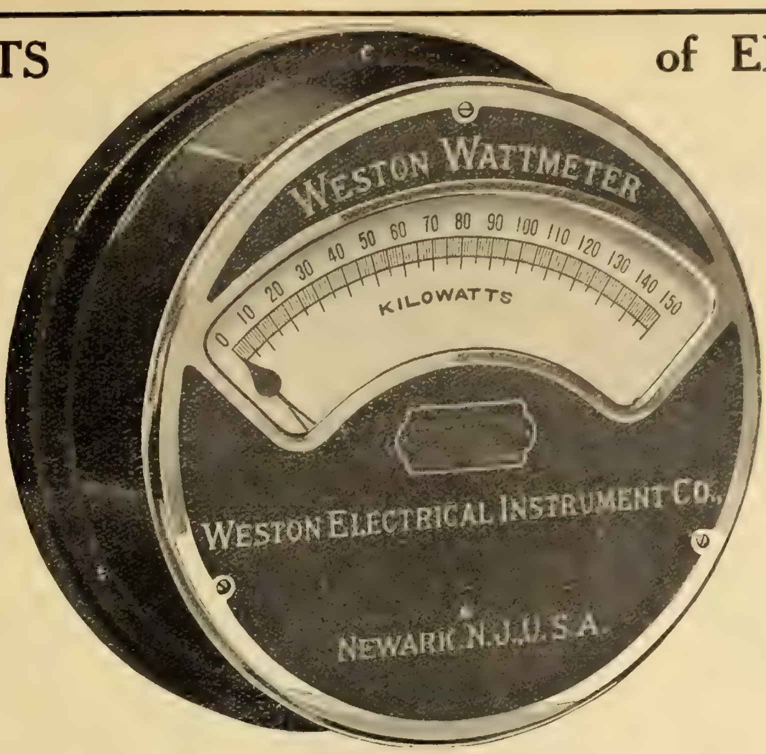
(3) The inventories of stores on hand at 31st December, 1912, while checked by us as to calculations—have been accepted in the usual way as to quantities and prices on the certificates of responsible officers. The inventory of stores on hand at 31st December, 1911, amounted to approximately $113,000 less than the stores which, according to the books, should have been on hand at that date. The missing stores in the interval have been traced and satisfactorily accounted for, except to the extent of $6,562.06. In our opinion, after full inquiry, there is little doubt but that, subject to the usual wastage, which itself is a charge upon the operations causing it, the stores represented by this deficiency were consumed upon construction operations and through oversights in the stores department not charged thereagainst. The amount has therefore now been charged against Capital Expenditure Account.

(4) Our requirements as Auditors have been complied with, and in our opinion the annexed Revenue Account and Balance Sheet are properly drawn up so as to exhibit a true and correct view of the state of the affairs of the enterprise.

We may add that the interim approximate accounts prepared from time to time during the year subject to adjustment in some important matters, showed a less favorable result than is disclosed by the annexed accounts, for the reason that in the interest of safety they were loaded for contingencies to a greater extent than has proved necessary.

Respectfully submitted,
JOHN MACKAY & CO., Auditors.
Chartered Accountants.

TEN POINTS of EXCELLENCE



1. The scale is uniform throughout the entire range of deflection.

2. The readings can be made with practically the same precision on violently fluctuating loads as on steady loads.

3. The indications are equally accurate on direct-current circuits or on alternating-current **circuits of** any frequency, power-factor or wave form within commercial limits. Therefore, these watt-meters can be calibrated with direct-current and used on alternating-current circuits without change of calibration.

4. The scale is flat and is therefore easily read.

5. The pointer is entirely free from vibration produced by mechanical resonance.

6. The power consumption is extremely small.

7. They have a large overload capacity, which will allow the measurement of full power at power-factors below 0.50.

8. They are far more reliable and durable than any commercial wattmeter heretofore built.

9. They are accurate within the limits of scale reading, regardless of changes in temperature, frequency, power-factor and wave form, within the range of commercial practice.

10. The zero position of the pointer can be adjusted from the outside without removing the instrument from the board.

In the **Weston Switchboard Wattmeter** every heretofore existing difficulty has been satisfactorily overcome by intelligent design and skillful construction and the results attained with these instruments are far in advance of anything ever accomplished in the art of commercial electrical measurement. Send for catalogue giving full information regarding **our complete** line of **A.C. Switchboard** Indicating Instruments, Voltmeters, Ammeters, Wattmeters, Synchroscopes, Power Factor Meters, Frequency Meters, also D.C. Instruments.

Weston Electrical Instrument Company, **Main Offices and Works NEWARK, N. J.**

New York, 114 Liberty St.
Chicago, 1504 Monadnock Blk.
Boston, 176 Federal Street.
Philadelphia, 342 Mint Arcade.
Birmingham, Brown Marx Bldg.
Detroit, 44 Buhl Block.
St. Louis, 915 Olive Street.
Denver, 231 15th Street.
San Francisco, 682 Mission St.
Cleveland, 1729 E. 12th Street.
Toronto, 76 Bay Street.
Montreal, Winnipeg, Vancouver, Calgary } Northern Electric & Mfg. Co.
London, Audrey House, Ely Place, Holborn.
Paris, 12 Rue St. George.
Berlin, Genest St. 5, Schoenberg.
Johannesburg, So. Africa, F. Peabody Rice, Standard Bank Building, Harrison St.

BANNER TRADE MARK

"Banner"

TRADE MARK

BANNER TRADE MARK

Lighting Fixtures

Write to us for the latest designs in "up-to-date" electric fixtures.

Fixtures made from original drawings on short notice.

Ontario Lantern & Lamp Co., Limited,

HAMILTON, CANADA.

Condensed Department

RATE

Positions Wanted
Positions Vacant
Miscellaneous.
} 2 cents a word per insertion.

Tender advertisements, equipment for sale, etc., 15 cents per agate line (14 agate lines make one inch) per insertion.

Advertisers who wish to conceal their identity may do so by using an Electrical News box number without extra charge.

Car Ventilating Systems

The Vacuum Car Ventilating Company has commenced manufacturing Mechanical Car Ventilating Systems under Canadian Patent No. 128070, dated September 13, 1910, and is prepared to furnish same on demand. For detailed information and prices, address Lock Box No. 25, Windsor, Ont. 10-t.f.

For Sale

The Corporation of Hespeler will have for sale shortly:—

One 12 x 12 Goldie Ideal Engine, 315 r.p.m.

One C.G.E. 2300 volt, 26 ampere, single phase, 60 cycle Generator.

A number of 5 kw. Transformers and also a number of 60 cycle meters.

All of the above plant is now in commission and is being discarded, making way for a 25-cycle installation.

Kindly address any enquiries to the Chairman, Hydro-Electric Power Commission, Corporation of Hespeler, Hespeler, Ont. 6-7

FOR SALE

One 50 h.p., 25 cycle, 3-phase, 550 volt C. G. E. induction motor. Complete with pulley base and starting box. Practically new. The Hespeler Furniture Co., Hespeler, Ont. 7-9

Situations Vacant

WANTED—Operators familiar with A.C. Generators. Box 751, Electrical News, Toronto, Ont. 7-9

MOONLIGHT SCHEDULE FOR MAY, 1913

Courtesy of the National Carbon Company, Cleveland.

Date.	Light.	Date.	Extinguish.	No. of Hours
May 1	7 20	May 2	4 20	9 00
2	7 20	3	4 20	9 00
3	7 20	4	4 20	9 00
4	7 30	5	4 20	8 50
5	7 30	6	4 10	8 40
6	7 30	7	4 10	8 40
7	7 30	8	4 10	8 40
8	7 30	9	4 10	8 40
9	7 30	10	4 10	8 40
10	10 30	11	4 10	5 40
11	11 10	12	4 10	5 00
12	11 50	13	4 10	4 20
14	0 10	14	4 00	3 50
15	0 40	15	4 00	3 20
16	1 00	16	4 00	3 00
17	1 30	17	4 00	2 30
18	1 50	18	4 00	2 10
19	No Light	19	No Light	
20	No Light	20	No Light	
21	7 40	21	10 50	3 10
22	7 40	22	11 50	4 10
23	7 40	24	0 30	4 50
24	7 40	25	1 10	5 30
25	7 40	26	1 40	6 00
26	7 50	27	2 10	6 20
27	7 50	28	2 30	6 40
28	7 50	29	2 50	7 00
29	7 50	30	3 10	7 20
30	7 50	31	3 30	7 40
31	7 50	Jun. 1	3 50	8 00

Total Hours............175 40

UNION MOTORS FOR ALL INDUSTRIAL PURPOSES

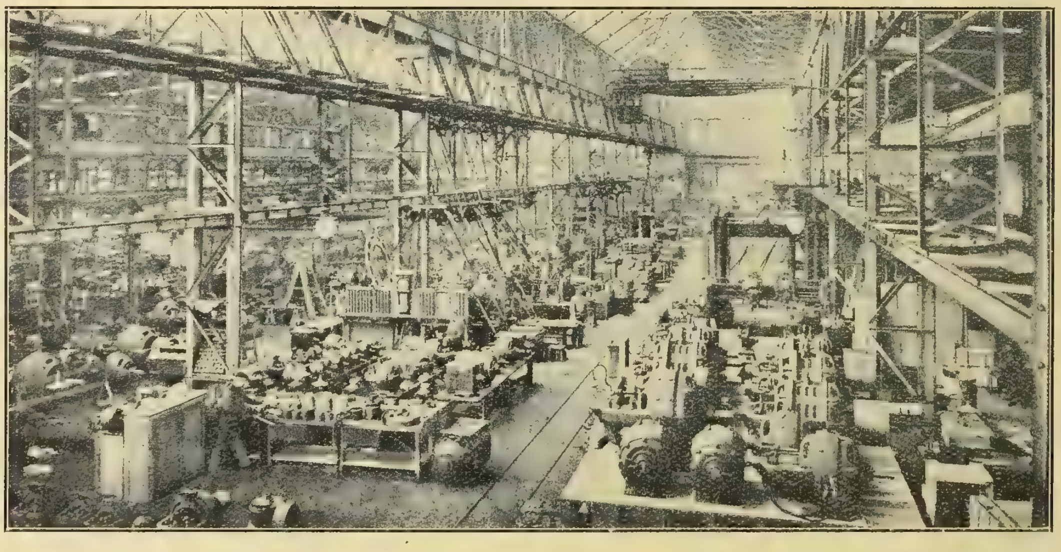
Stock carried in

Montreal - Toronto - Winnipeg

ARC LAMPS

DYNAMOS

MOTOR GENERATORS



TRANSFORMERS

STORAGE BATTERIES

INSTRUMENTS

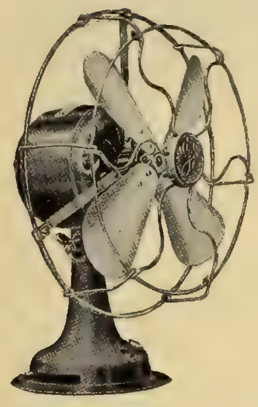
A photographic view of one bay in the Factory showing Union Dynamos and Motors in process of manufacture.

Canadian Union Electric Co.
Limited
122 Wellington St. West, TORONTO—Tel. Adel. 3150
9 St. Nicholas St. Montreal

Mainer Electric Co., Limited
61-63 Albert St., Winnipeg, Man.
Representatives for Manitoba, Saskatchewan, Alberta.

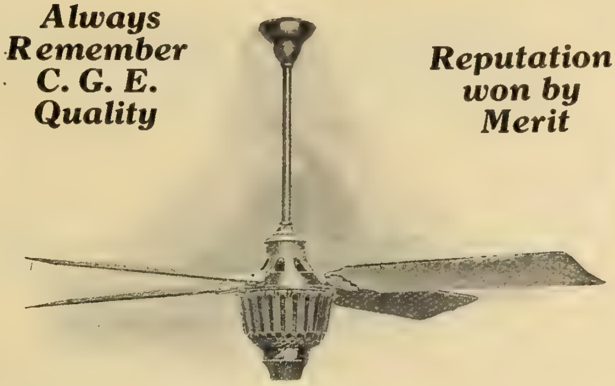
Electric Fans

1913



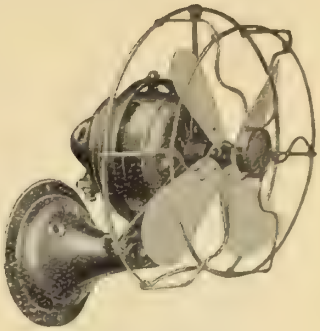
Desk Fan

Always Remember C. G. E. Quality

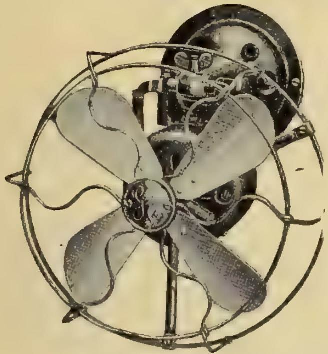


Ceiling Fan

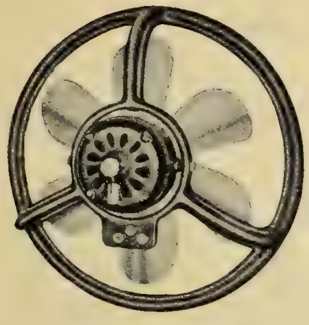
Reputation won by Merit



Oscillating Bracket Fan



Telephone Booth Fan



Ventilating Fan

Our 1913 Fans are thoroughly representative of both **merit** and **quality** and well worth your careful consideration.

We suggest that you endeavour to **anticipate your requirements** well in advance—Place your orders **early** and not be caught without stock when the warm weather arrives.

Our nearest district office will be pleased to give you **new** descriptive matter and **latest** prices.

Canadian General Electric Co., Limited

Head Office: TORONTO

Montreal Halifax Ottawa Cobalt Porcupine Winnipeg Regina Saskatoon
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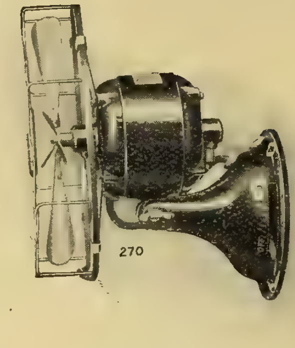
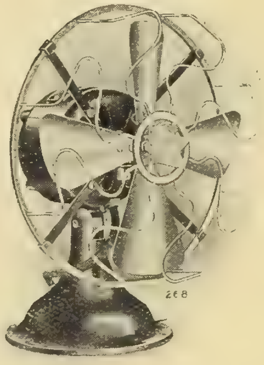
A Live Fan Proposition For Live Dealers !



New 8-inch Induction Type in Wall Bracket Position

This will be a bigger "Standard" Fan season than ever before. Hundreds of wide-awake electrical dealers who have seen the demand for "Standard" Fans grow amazingly from year to year have already sent in their orders. If you haven't made your arrangements for "STANDARD" Fans for the coming season, we'd advise writing for our proposition without delay.

Robbins & Myers "STANDARD" Fans



New 8-inch Induction Type in Desk Position

made in a full assortment for either direct or alternating current. We have just perfected a splendid seller for home use, a new induction type 8-inch Fan, finished in a superb black enamel with guard and blades in brushed brass as the standard, or finished entirely in any of the popular plated finishes; or in white enamel—whatever finish may be desired.

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THE ROBBINS & MYERS CO.
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We also manufacture a complete line of small D. C. and A. C. Motors for all purposes.

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A large and varied stock carried at our Winnipeg warehouse including

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INCANDESCENT LAMP CORD
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Special Cords and Cables for all kinds of Electrical Work

Prompt Shipments from Canadian Factory

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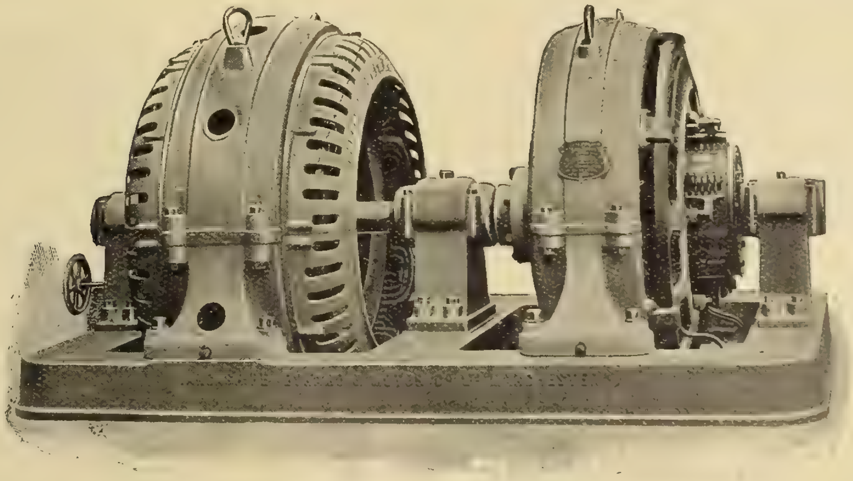

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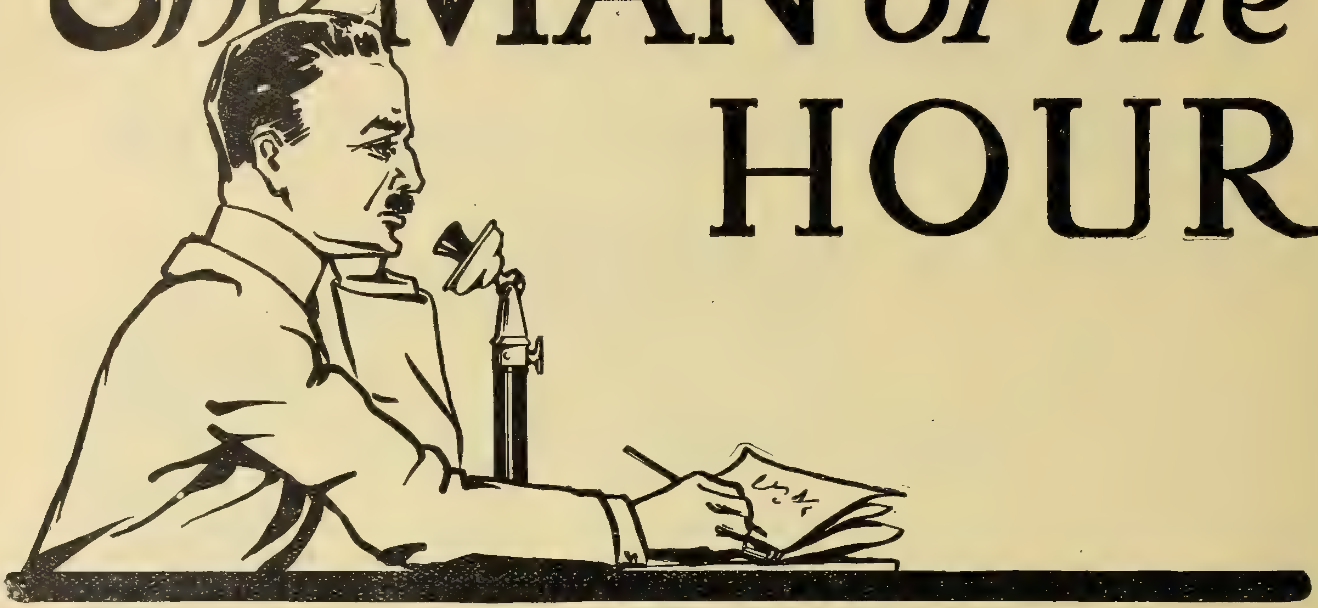

He TELEPHONES instead of writing, walking, or riding, whenever he can, therefore saves energy and doubles his efficiency.

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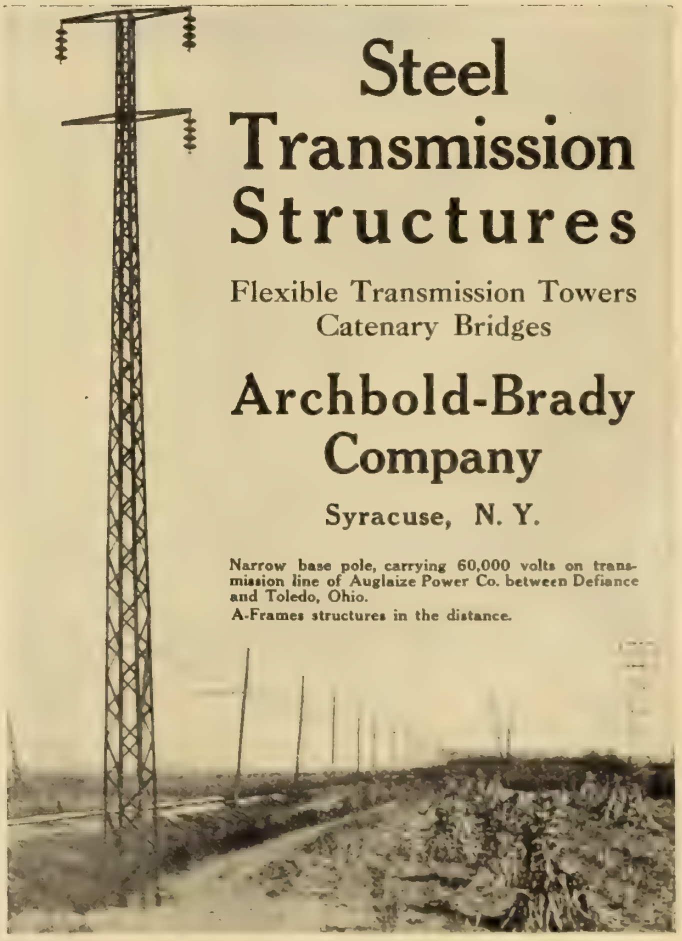

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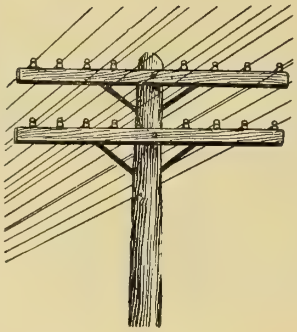

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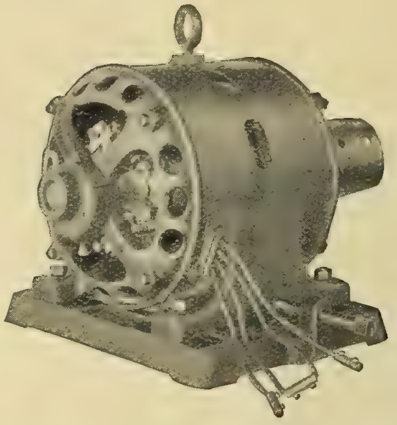

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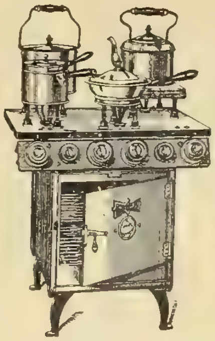

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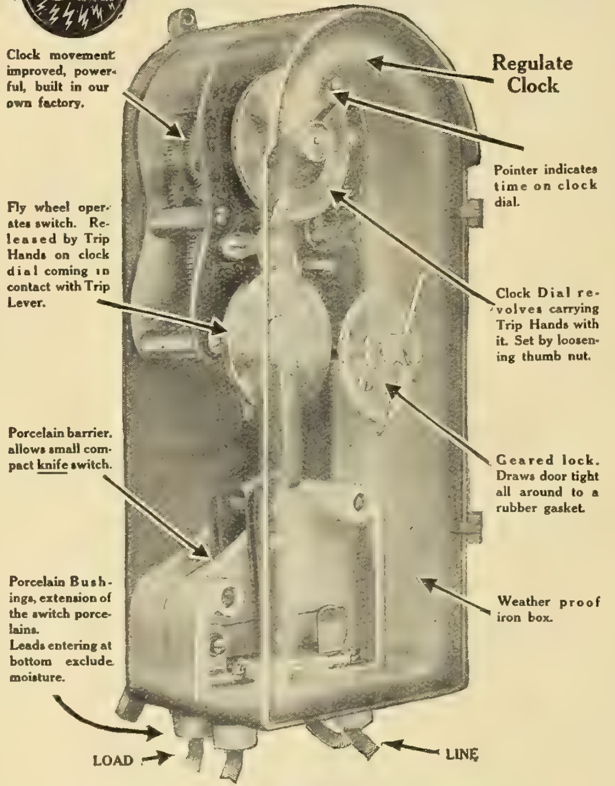
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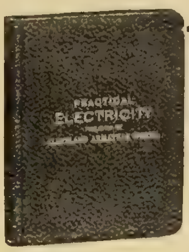

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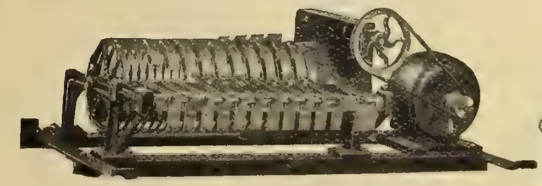

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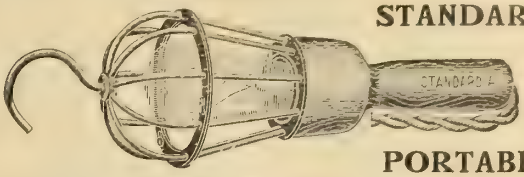

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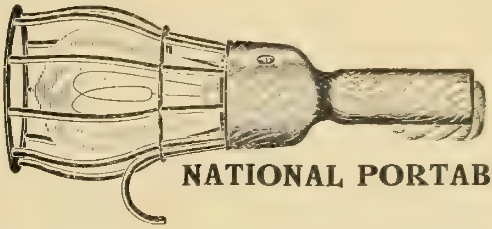

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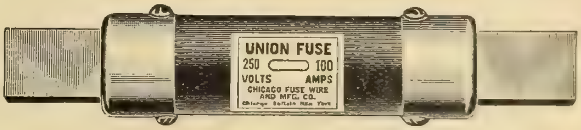

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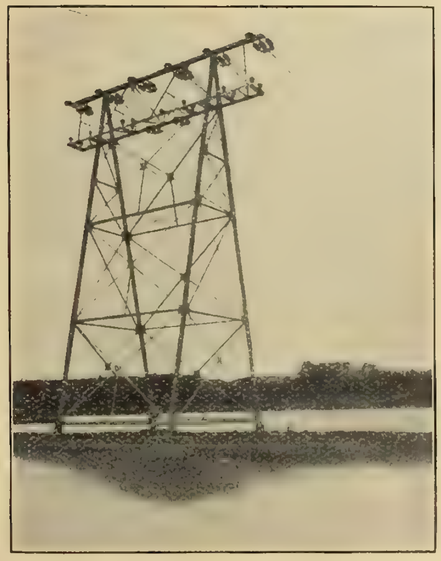

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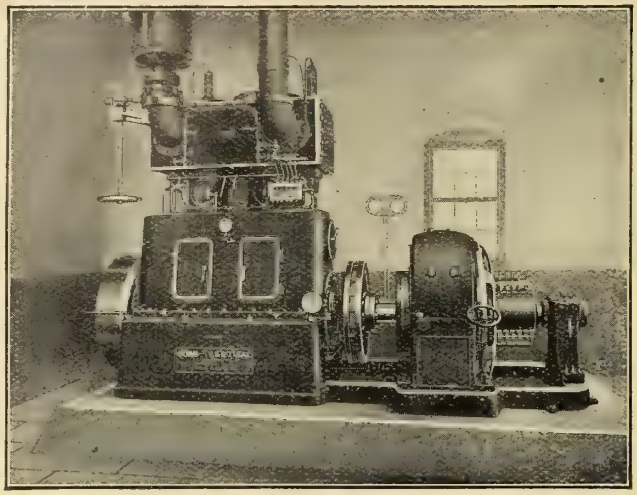

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39-44

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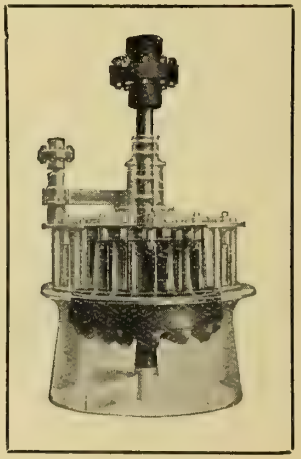
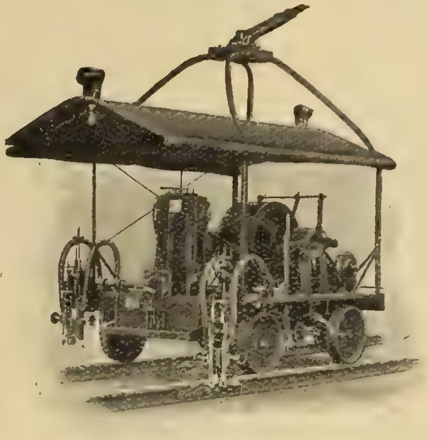


Electric Weld Rail Bonds



The conductivity of Bonds installed by our process can never be impaired by moisture or corrosion.

When once installed, they are on to stay and cannot be removed without actual mutilation and considerable hard work.

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The
Electric Railway Improvement Co.
Office and Works, 6005 Carnegie Avenue
CLEVELAND

Longer Life at Lower Cost

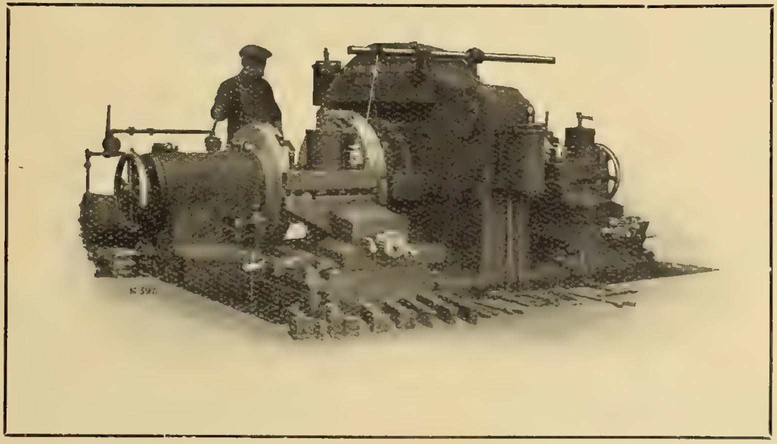
For Satisfying Results in Underground Subway and Power House Construction specify American Bitumized Fiber Conduit Strongest and most durable conduit made.

Electrolysis proof—water-proof—gas proof

Write for Booklet and General Information

American Conduit Co.
140 Nassau St., New York - East Chicago, Indiana

Heavy Railway Shop Tools



WE manufacture a large and complete line of Locomotive and Car Shop Machinery.

The illustration shows our latest design 42-inch Steel Tired Car Wheel Lathe equipped with Pneumatic Tool Clamps, Automatic Segment, Air Attachment for moving and clamping the Tailstocks, Power Wheel Lift for centering the axles in place and Calipering Device.

The JOHN BERTRAM & SONS CO., Limited
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DOSSERT CONNECTORS
for
Rotary Converter Terminals
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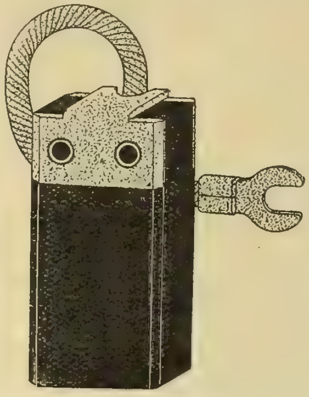
No energy wasted in excessive heat where connections are made with DOSSERT Lugs.

DOSSERT & COMPANY
242 West 41st Street New York
General Representative for Canada: IRVING H. SMITH,
406 St. Nicholas Building, Montreal



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is invariably obtained wherever LE VALLEY VITAE BRUSHES are intelligently used.

VITAE BRUSHE
REDUCE Commutator Repairs
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SAVE Shut-down Losses
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Why experiment.
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Samples gladly sent

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Practically only two parts—door and back reflector case; reflector and back case in one piece.

Reflector of white porcelain enamel.

Can furnish either semaphore or plain lens.

No. 14

No. 15

Made in type to be set in dash, or to be screwed outside of dash.

Weight is but ten pounds, as compared with 25 of cast iron.

Can furnish ruby lens to be used as rear markers.

The Trolley Supply Company
Canton, Ohio, U. S. A.

Special Prices on Electrical Books

The Following Books are Offered Subject to Previous Sale

The Steam Turbine, by Robert M. Neilson. Published in 1903 by Longmans, Green & Co., 294 pages, illustrated. Price $1.00.

Telegraphy, bp Sir W. H. Preece, K.C.B., and Sir J. Sivewright, M.A. Published in 1905 by Longmans, Green & Co., 504 pages. Price $1.00.

Electro-Dynamos, by Charles Ashley Carus-Wilson. Published in 1898 by Longmans, Green & Company. 298 pages, Price 50c.

Elementary Lessons in Electricity and Magnetism, by Silvanus P. Thompson. Published in 1895 by MacMillan & Company, 628 pages, illustrated. Price 50c.

Electric Lighting & Heating, by Sydney F. Walker, Published in 1907 by Norman W. Henley Publishing Company. 438 pages, illustrated. Price $1.00.

Dynamo-Electric Machinery, by Francis B. Crocker, E.M., Ph.D. Published in 1908 by American School of Correspondence. 236 pages, illustrated. Price $1.00.

Telephone Law, by A. H. McMillan. Published in 1908 by McGraw Publishing Company. 332 pages. Price $1.50.

Explanations of Switch and Signal Circuits. Published in 1907 by Doran & Kasner. 140 pages. Price 40c.

Practical Methods of Electro-Chemistry, by F. M. Perkin, Ph.D. Published in 1905. 322 pages. Price $1.00.

Treatise on Thermodynamics, by Dr. Max. Planck. Published in 1903. 272 pages. Price $1.00.

Text-Book of Electrochemistry, by Svante Arrhenius. Published in 1902. 344 pages, illustrated. Price $1.00.

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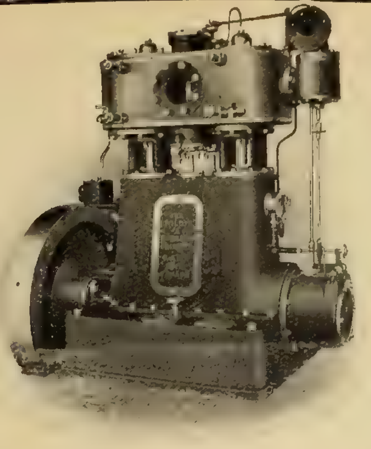

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Quick Revolution Engines

With Combined Throttle and Expansion Governor

These engines are giving excellent service wherever installed. They are built for service and are economical in consumption of steam and require little or no attention while running. The materials used are in accordance with British Admiralty Specifications. Ask for detailed information.

All Engines are Tested under Steam before leaving our works

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"The Recognized Authority on Wiring and Construction"
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Member American Institute of Electrical Engineers; formerly Electrical Inspector for Boston Board of Fire Underwriters and Underwriters' Tariff Association of New York.

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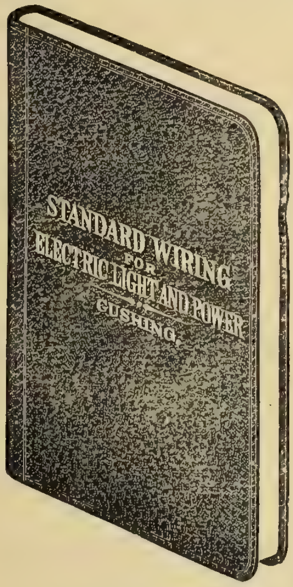

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is the only book on Electric Light and Power Wiring and Construction endorsed and recommended by every Board of Fire Underwriters in the United States and Canada, because it is the only one kept strictly up-to-date and revised every year in accordance with every rule and requirement of the

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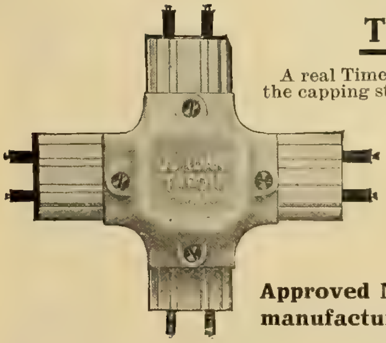

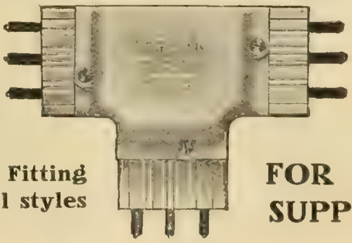

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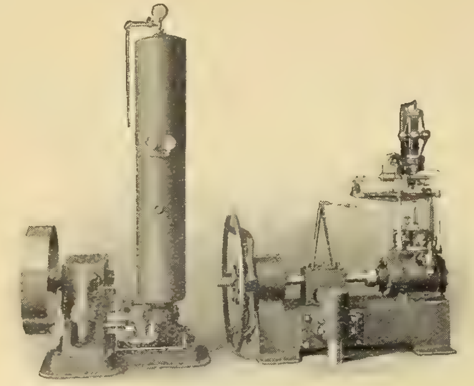

Direct Connected Governor for Vertical Wheels.
6,000 ft. lb. Capacity.

THE GOVERNOR FOR YOUR CONDITIONS

We are specialists in the manufacture and application of hydraulic governing apparatus.

The knowledge and the shop equipment which enable us to build the 250,000 ft. lb. governors for the Mississippi River Power Co. at Keokuk, are at the command of the purchaser of any of our governors.

WHAT IS YOUR PROBLEM?

THE LOMBARD GOVERNOR CO. ASHLAND, MASS.

"A"

Splicing Compound

Made by pioneers of insulation engineering. "A" splicing compound is noted for its reliability and will be found excellent for rush jobs because it can always be relied upon.

Walpole Rubber Co., Ltd.
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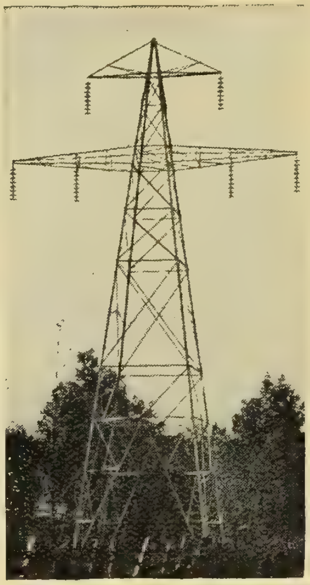
Liquid and Rubber Insulation

American Co.: **Massachusetts Chemical Co.**
Walpole, Mass.
Pioneers in Insulation Engineering

TRANSMISSION TOWERS



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One of 3,300 Towers furnished for the 300 mile Transmission Line of the Hydro Electric Power Commission of Ontario Transmitting a 110,000 volt current from NIAGARA FALL to the principal cities of ONTARIO.
The largest single order of Transmission Towers ever placed

Hot Galvanized or Painted

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Structural Steel of all kinds

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TRADE MARK

Canadian
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Drop Forgings

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Send us blue prints or models for estimates.

Yager's
Soldering Fluxes

4 Forms—1 Result—A Perfect Joint

We don't ask you to take our word for it that **YAGER'S** Fluxes are the best—we want you to give them your severest test **AT OUR EXPENSE** and prove it for yourself. Send to us for samples of the kind you want, with your dealer's name and address and make your own tests.

Yager's Salts have been improved and kept up-to-date. Yager's **Stick, Paste,** and **Fluids,** are New Forms on the Yager's Salts base for greater convenience.

Write Now for Sample and Discounts to the Trade

ALEX. R. BENSON COMPANY
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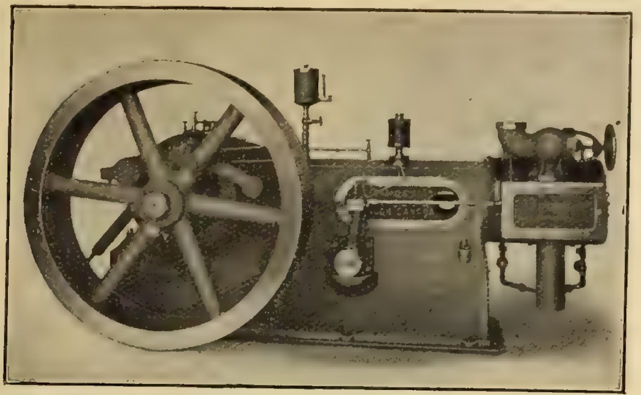
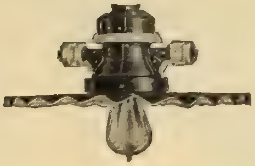


Engines of All Types
for
Electrical Service

BOILERS — HEATERS — PUMPS
TANKS AND STACKS

E. Leonard & Sons, London, Can
AGENCIES: ST. JOHN, N.B. MONTREAL TORONTO
WINNIPEG CALGARY VANCOUVER

Street
Illumination
By Multiple and
Series
Pemco
Fixtures



"The Practical Fixture"

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Philadelphia Electric and
Mfg. Company
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Canadian Representative
A. H. Winter Joyner, Limited
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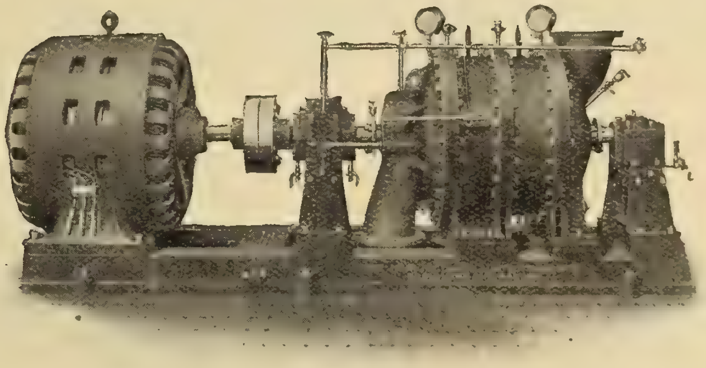
TURBINE PUMPS



"RELIABILITY" is the strongest feature of "INGLIS" Steam and Motor Driven Pumps. They are guaranteed to give reliable and satisfactory service.

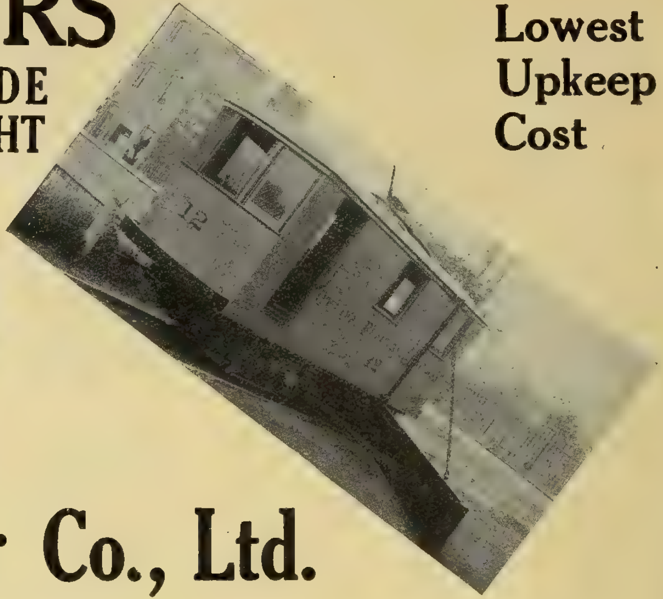
Write us for particulars.

The John Inglis Company, Limited **Engineers and Boiler makers**
14 Strachan Avenue, TORONTO, CANADA

Highest Efficiency

CARS
MADE RIGHT

Lowest Upkeep Cost



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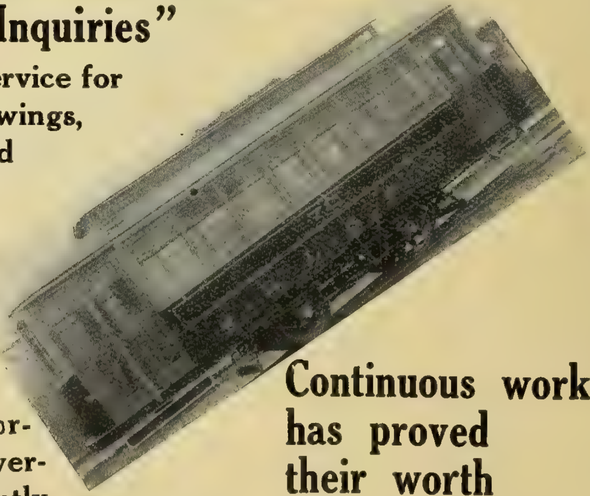
Ottawa Car Co., Ltd.

Car Designers and Builders of

Electric City and Interurban passenger cars. Electric express cars and locomotives. Sprinklers and work cars. Car seats, car curtains and a very large variety of brass and bronze car fittings.

Snow Sweepers and Plows—the most perfect design and construction simple mechanism—quick and effective operation. An immediate delivery can be made of Standard Sweepers, special types designed and built or built to your own specifications.

"Send Them Your Inquiries"
as they are at your service for specifications, drawings, estimates and prices.



Always Ready for Service

Satisfaction assured on all orders and deliveries made promptly.

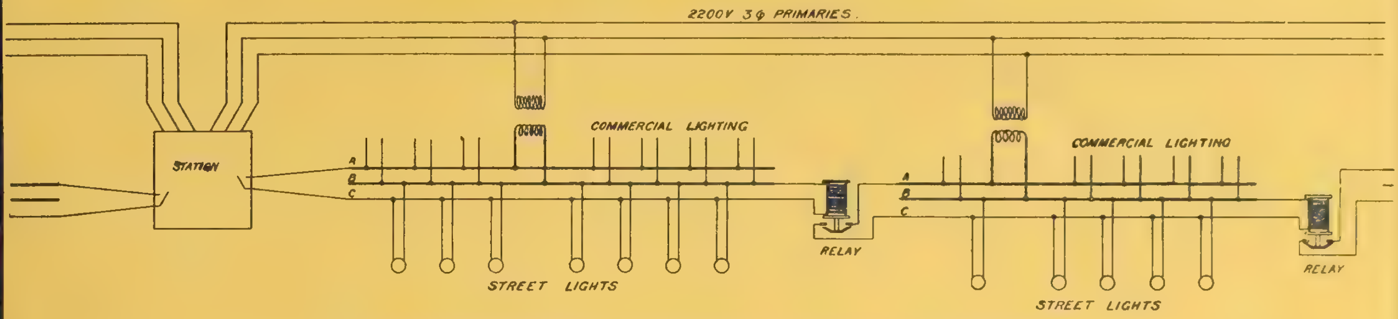
Continuous work has proved their worth

Remember the Address: COR. KENT AND SLATER STS., OTTAWA, ONT.

DID YOU SEE THIS

You Electrical Engineers

Look up in your April 1st number of Electrical News the description of installation at Canora, Sask.



The following extract referring to above cut is interesting

"The distribution system adopted was one which has been proved satisfactory in some eastern towns and is giving every satisfaction in Canora. The accompanying sketch, Fig. 4, shows the method adopted. **THE SOLENOID SWITCHES WERE SUPPLIED BY THE ELECTRICAL MAINTENANCE & REPAIRS COMPANY, LIMITED, TORONTO.**

Do you know that the Hydro-Electric Commission have adopted our system as their standard and have our switches now in use in

Guelph
Brampton
Merritton
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Mimico
Port Dalhousie
Port Stanley
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Niagara Falls (Niagara Falls Power Co.)
Milton
Beachville
Acton
Georgetown
Baden

Norwich
New Hamburg
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Woodstock
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Rockwood
And other places

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The Electrical Maintenance & Repairs Co., Ltd.

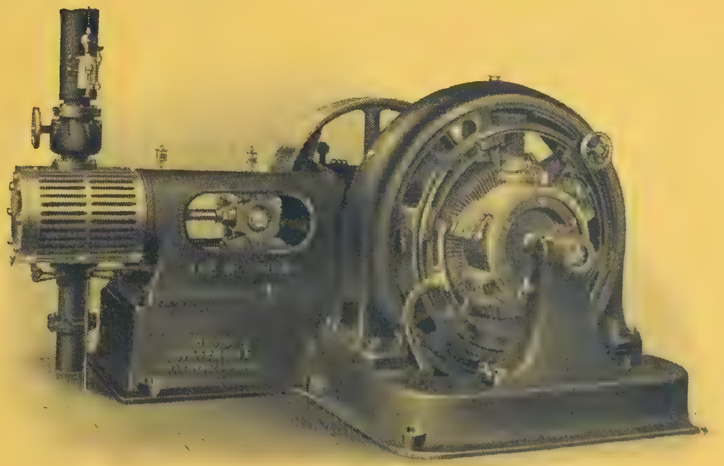
Long Distance Phones A-902-903

162 Adelaide St. West, TORONTO

Nights, Sundays and Holidays,
Geo. T. Dale, Mgr. Beach 1723

Is Your Engine Investment Paying You?

A 'low priced' engine is the poorest kind of power investment you can make. Periodic shut-downs and monthly repair bills keep you always from being 'paid up in full'. Good service makes you forget what you PAID for your engine; constant trouble reminds you what it IS COSTING you.



McEwen Engines

are built with an eye to the future. They are not 'low priced' but they have an earning power that makes them 'low cost' machines. Every dollar you put into your McEWEN you get out in economical operation and reliable, satisfactory service.

They are your best insurance against shut-downs and large repair bills.

Hundreds of Canadian users will testify to this.

Booklet "The McEwen Engine" on Request

The Waterous Engine Works Co., Ltd., Brantford, Canada

Murray Patents

Loss of current means loss of dollars

stop it by

The Metropolitan Method

it is

The only complete System

that

Reduces cost of testing.

Provides for complete control of service and meter by the central station.

Provides protection to the meter.

Prevents theft of current.

Is adaptable to any size or type of meter.

Can be used with any system of wiring.

"Reduces cost of operation"
"Increases percentage of revenue"

This is what many progressive central station men say after installing our devices.

LET US EXPLAIN.

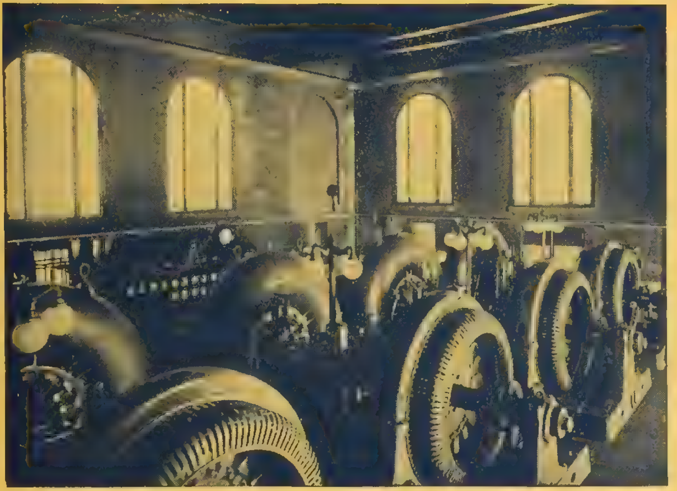
The Metropolitan Engineering Co.

90 Sherbourne Street
Toronto

Vol. XXII—No. 9 Toronto, May 1, 1913

Electrical News

Generation, Transmission and Application of Electricity



"Smith" Francis Turbines

Power house of the Metropolitan Water and Sewerage Board, Clinton, Mass. (now owned by State of Massachusetts), where we have four hydraulic turbine units, each of 1600 Horse Power, under 100 ft. head, in constant operation. Turbines designed for heads from 5 feet to 600 feet.

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S. Morgan Smith Co., York, Pa.

Branch Offices: 176 Federal St., BOSTON, MASS.
644 American Trust Bldg., CHICAGO

TYPE W LONG LIFE FLAME ARC LAMP

BEST BY COMPETITIVE TEST

Some Features of the TYPE W

Can be furnished in Multiple or Series Type, both A.C. and D.C.

Long electrode life (100 - 125 hours) with consequent low cost of maintenance.

Only one electrode needs renewing at each trim.

The brilliancy remains unimpaired throughout the trim.

Simplicity of parts and operation.

The Arc always remains in the same position, giving uniform illumination.

The lamp gives from 13 to 21 downward lumens per watt depending on the circuit upon which it is used.

The casing is weatherproof and insect-tight.

Type W Long Life Flame Arc Lamp.

For Economic Lighting of Large Areas Everywhere

AND IS PARTICULARLY ADAPTED FOR USE IN

Automobile factories,
Armories,
Repair shops,
Baggage rooms,
Car shops,
Locomotive works,
Cement mills,
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Expositions,
Smelting plants,
Rolling mills,
Excavation work,
Forging shops,
Foundries,
Freight platforms,
Glass factories,
Machine shops,
Piers,
Paper and pulp mills,
Parks,
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Wire manufacturers
Yard lighting,
Theatres and stores,
(For exterior advertising)

Canadian General Electric Co., Limited

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Calgary Edmonton Vancouver Victoria Nelson Prince Rupert

Alphabetical Index to Advertisers Page 8

PHILLIPS

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Bare and Insulated Copper Wires and Cables.

Bare and Insulated Electric Wire and Cables for Aerial and Underground Use.

Railway Feeder and Trolley Wire.

Weatherproof Magnet and Rubber Covered Wires and Cables.

Incandescent and Flexible Cords.

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Branches: HALIFAX TORONTO WINNIPEG VANCOUVER

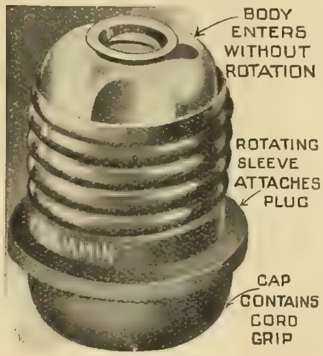
BENJAMIN PROFIT TIME

92

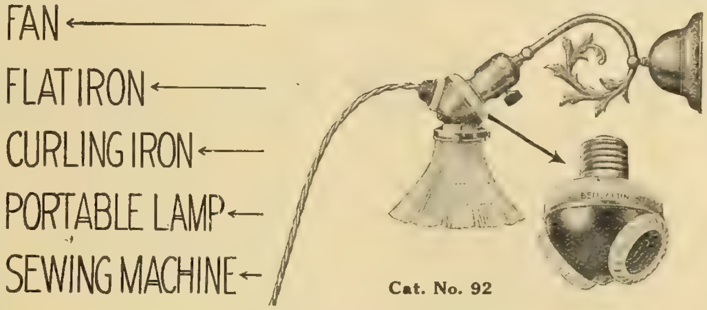
903

Sell a
92
Plug Cluster
with
Every Fan

Attach a
903
Attachment Plug
to
Every Fan



Cat. No. 903



Cat. No. 92

This is the season of the year when you are buying, talking, and selling Fan Motors.

MAKE MORE PROFITS

With every Fan sell a **92** Plug Cluster.
To every Fan attach a **903** Attachment Plug.

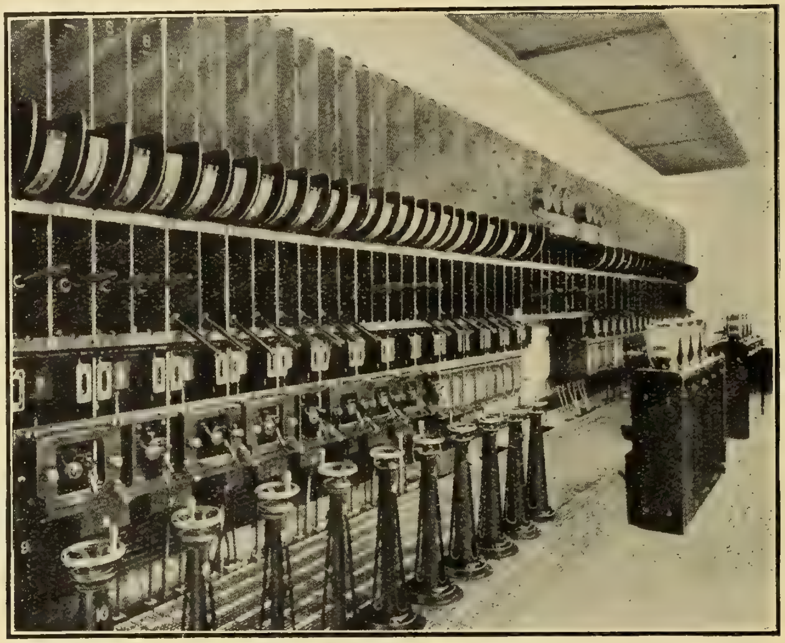
"BUY BENJAMIN"
Made in Canada
FROM YOUR JOBBER

BENJAMIN ELECTRIC MFG. COMPANY

of Canada, Limited

11-17 Charlotte St.
TORONTO

FERRANTI



SWITCHBOARDS

ABOVE illustrated is a heavy duty D. C. Ferranti Switchboard—a type specially suited to railway use.

Ferranti are leaders in the designing and manufacturing of both D. C. and A. C. Switchboards of every size and type.

Ferranti meters will be found accurate in operation, simple in construction and requiring little attention.

Let us quote on your Meter and Switchboard Requirements.

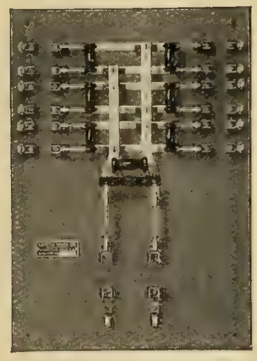
The Ferranti Electrical Co. of Canada, Ltd.

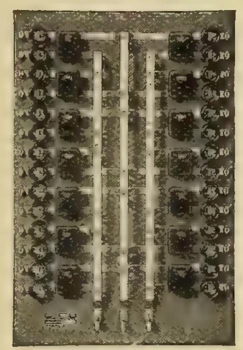
TORONTO
90 Sherbourne St.

WINNIPEG
56 Albert St.

Panel Boards and Cabinets

That Embody Advanced Structural Principles
Material and Workmanship, the Best


Type A Panel


Type H Panel

Our line of Panel Boards includes four distinct types, each made in single and double branch forms, with mains carrying lugs only, fuses, fuseless knife switch, and fused knife switch for 2 to 2 and 3 to 2 wire systems. Three to 2 wire Panel Boards are made in convertible form, as well as the standard construction.

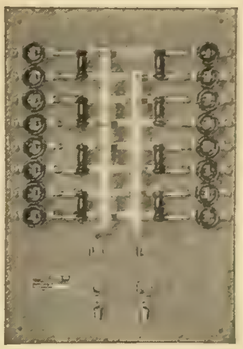
Type "A" Panels [125 and 250 volts]—Branches arranged for enlosed fuses and with or without knife switches.

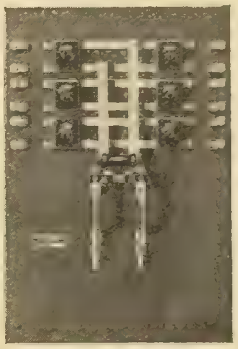
Type "D" Panels [125 volts]—Branches arranged for plug fuses and with or without knife switches.

Type "F" Panels [125 and 250 volts]—Branches arranged for enclosed fuses and snap switches.

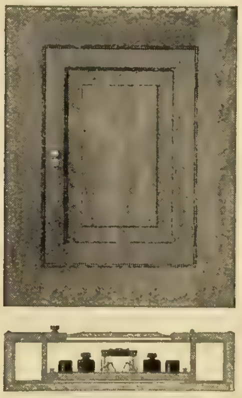
Type "H" Panels [125 volts]—Branches arranged for plug fuses and with snap switches.

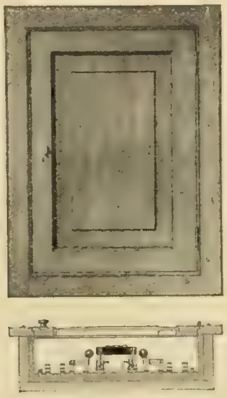
Our designs in Cabinets embrace fifteen types—all steel, steel and wood combined and wood with slate lining, either for flush or surface mounting and with side or back gutters, also without gutter.


Type D Panel


Type F Panel

Type M Cabinet


Type DFP Cabinet


Type ESQ Cabinet

Typc CL Cabinet

If your dealer does not stock them, write us
"Panels and Cabinets," Bulletin No. 1, sent free upon request

Crouse-Hinds Company of Canada, Ltd.

Main Office and Works:
Toronto, Ontario, Canada

Kindly send me free copy of Condulet Bulletin No. 101.
Name
City
Prov

ADANAC Red Core Rubber Covered WIRES & CABLES

RUBBER COVERED · TRADE ADANAC MARK · WIRES AND CABLES

Adanac Red Core Rubber Covered Wires and Cables

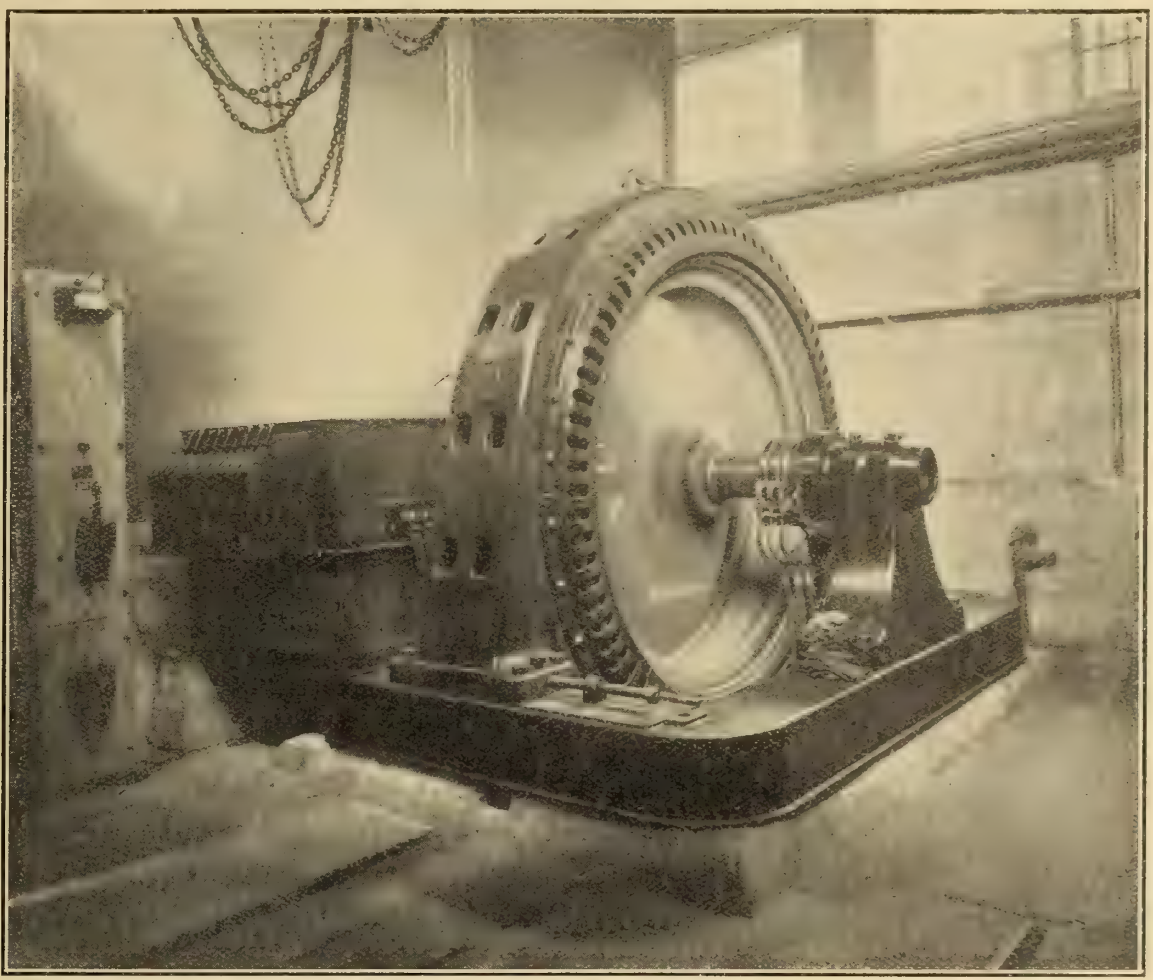
are made according to the specifications of the National Board of Fire Underwriters. The conductors are drawn from copper of the highest conductivity and are covered with two thicknesses of thoroughly vulcanized rubber compound of high quality. The wires are braided over insulation and the smooth high finish they receive makes them specially desirable for conduit work.

IMPERIAL WIRE & CABLE COMPANY Limited MONTREAL

THE Northern-Electric AND MANUFACTURING CO. LIMITED
SALES AGENTS

TORONTO WINNIPEG
REGINA
CALGARY VANCOUVER

High Grade Electrical Apparatus



1000 H.P. 22000 volt, 3 phase, 60 cycle, 257 R.P.M., induction motor direct connected to pulp grinders at Northumberland Pulp Co., Campbellford, Ont.

Kilmer, Pullen & Burnham,
LIMITED

Head Office,
TORONTO

Branch Offices: MONTREAL
General Supplies Ltd.,
CALGARY, ALTA.

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The General Electric Co., of Sweden

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The Best Endorsement of the value of the "Electrical News" as an advertising medium is the above List of Advertisers

Winnipeg General Hospital—A "Galvaduct" Building

"GALVADUCT"

AND

"LORICATED"

The above two conduits are carrying the wires in most of the large buildings in Canada. They are used in every type of building and afford safe and convenient protection for the wires.

"GALVADUCT"—The most perfect interior construction conduit on the market, recognized as the standard of high quality.

"LORICATED"—A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive Agents.

Specify these Conduits

If your jobber cannot supply you—Write us.

Conduits Company
Limited
Toronto - Montreal

WIRES

and

CABLES

Bare and Insulated in Copper and Aluminum

Railway Feeder Cables

in Copper and Aluminum

Copper Trolley Wire

Copper Clad Wire

(Duplex Metals)

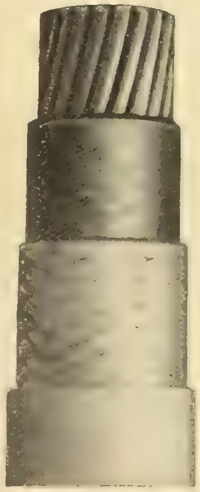
Galvanized Steel Strand Guy Wire

Canada Wire & Cable Co.
Limited
1170 Dundas Street, TORONTO

Stocks of Wire and Cable carried in Toronto, Montreal, and Winnipeg.

SALES AGENTS:

Roper, Clarke & Co. Limited, MONTREAL
A. E. Esling, Scott Block, WINNIPEG
Macdonald, Marpole Co. Limited, VANCOUVER
Messrs. Gorman, Clancey & Grindley, Ltd. CALGARY and EDMONTON



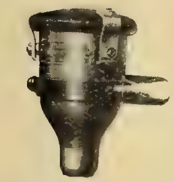
Where Quality Wins

Climatic conditions at Panama require that electric cables be given the best possible protection against moisture. That is **one** reason why

"STANDARD" Cable Terminals

were bought in large quantities by the U. S. Government for use in the electrification of the Canal. If you want the best protection for your cables, let us explain why "Standard" Terminals, with their patented features, are best.

Write our nearest office



Above illustrations show one type of terminal supplied and partial shipment of same.

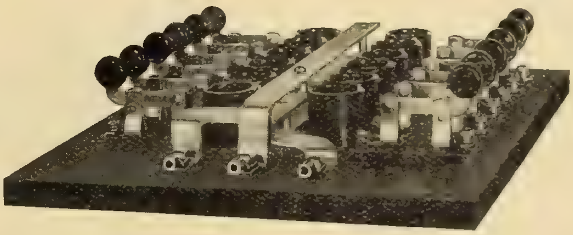
Standard Underground Cable Co.,
of Canada, Limited,

Montreal, Que.
Boston, Mass.
Hamilton, Ont.
Winnipeg, Man.
Seattle, Wash.

This and above illustration show types of terminals supplied.

YOU CAN SAVE

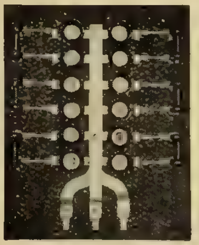
TIME, MATERIAL AND
. SPACE BY USING .



Cutter Panel Boards

The Bus Bars are mounted one above the other so that they occupy the space of only one bar on the face of the panel. The other bars occupy hitherto unused space, and it is practically impossible to short-circuit a Cutter Panel Board. The result of this construction is a reduction in the size of cabinet, linings and space required for mounting.

Cutter Panel Boards in all sizes and types are described and listed : : in Catalogue No. 12. Ask for your copy. : :

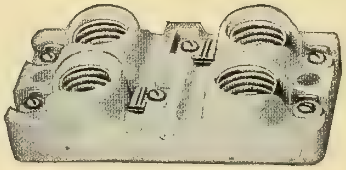


George Cutter Company

423 Notre Dame Street, South Bend, Indiana, U. S. A.

DUNCAN

Edison Plug Cutouts and Entrance Switches of Duncan Quality



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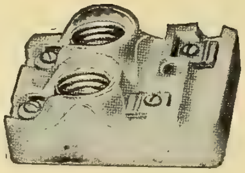

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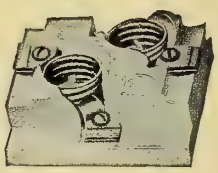

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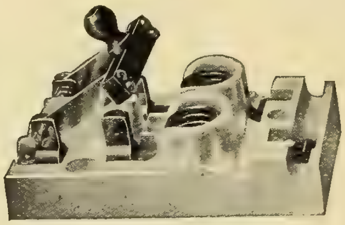
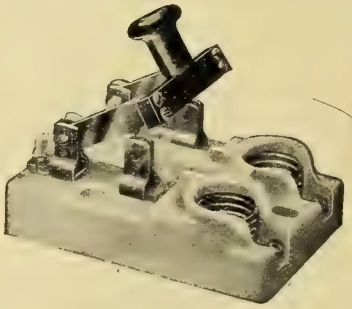


No. 1851 (¼ Full Size)



No. 1695 (¼ Full Size)

TRADE DUNCAN MARK

There's your Guarantee

Order through your Jobber

The—

Duncan Electrical Co.

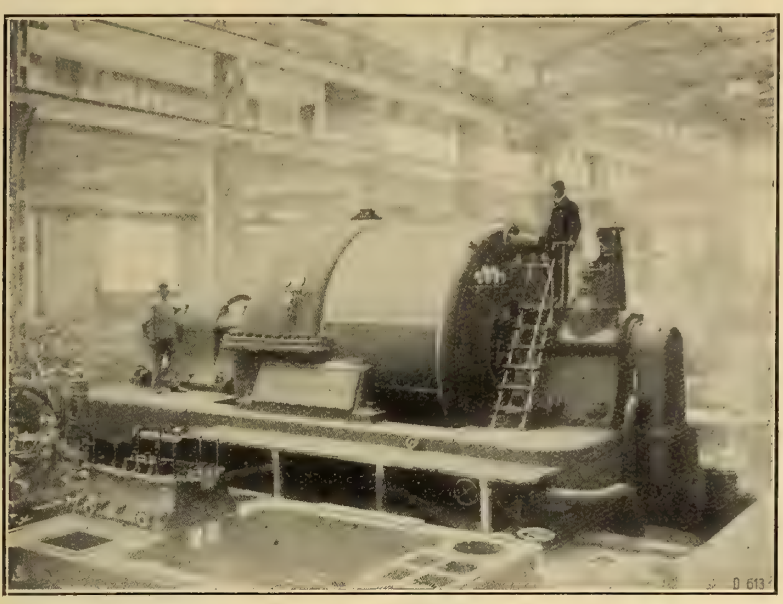
Limited

MONTREAL

Makers of Electrical
Supplies

D E Co

ESCHER WYSS



28,000 H. P. Zoelly Steam Turbine

Zoelly Steam Turbines

From 300 to
15,000 K. W.

Also
Water Wheels
Impulse Wheels
Pumps, Etc.

Escher Wyss & Co., 626 Coristine Bldg., Montreal

There are over 40,000 individual installations of

Folding Tungstoliers

(Catalogue No. 20a)

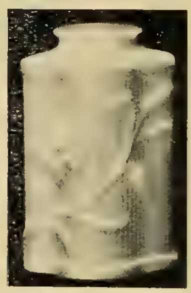
Representing over $2,000,000 invested.
There must be a reason for this.
Get acquainted with Tungstolier Service and
you will know the reason.

The Tungstolier Company
of Canada, Limited
Head Office: 212 King Street West, Toronto

No. 0356 Vel.

No. 0368 Vel.

No. 0354 Vel.



No. 01158 Vel.

No. 0358 Vel.

"Veluria" "Calla" "Sudan"

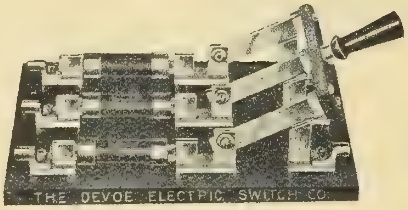
The three most beautiful of white glasses.
For High-class Fixture Work and Semi-Indirect Units.
Artistic, Efficient and of Unexcelled Quality.

The Holophane Co., Limited **Toronto, Canada**

Order at once **Our Holophane is made in Canada**

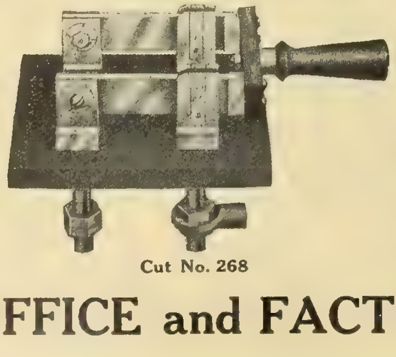
The Devoe Electric Switch Company

Manufacturers of
Switches, Switchboards, Panelboards, Iron Boxes and Cabinets



Cut No. 343

An examination of "DEVOE" Standard Panels, Switches and Switchboards will convince you they are the best made.



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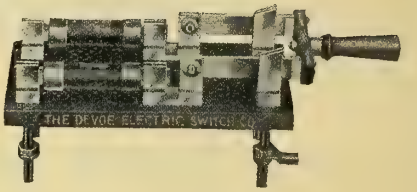
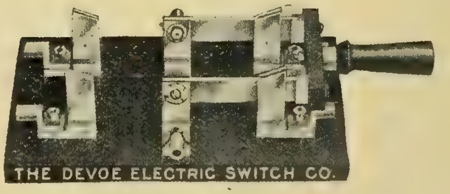


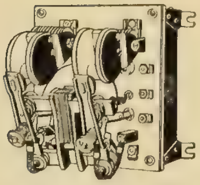
Cut No. 2005

Every "DEVOE" product is built for efficient service under actual operating conditions.

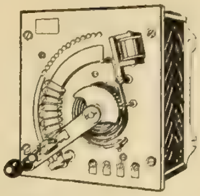


Cut No. 205

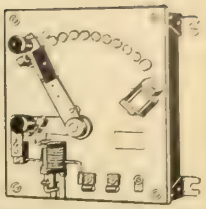
OFFICE and FACTORY, 157 Craig St. West, MONTREAL



Magnetic Self Starting Switch for A. C. Motors. Bulletin 9600.



Motor Regulator giving wide speed variation. Bulletin 3260



Motor starting Rheostat with adjustable indicating overload Device. Bulletin 2210.

Surely You Will Want Some of These Bulletins

Below are the principal sub-divisions of the new Cutler-Hammer Catalog—striking evidence of the extensiveness of our standard line of controllers. Just tell us in what class or classes of devices you are interested. We can make up sectional booklets which will contain complete sets of bulletins covering controllers for any kind of service.

C-H Direct Current Apparatus

Motor Starters—Manually operated types	20	Bulletins	70	pages
Speed Regulators—Manually operated types	16	"	84	"
Self Starting Speed Regulators	7	"	30	"
Printing Press and Machine Tool Controllers	30	"	94	"
Drum Type Controllers	25	"	42	"
Crane and Hoist Controllers	14	"	90	"
Automatic Starters (including magnetic switch type panels for steel mills and industrial plants) and Accessories	33	"	108	"
Elevator Controllers and Accessories	52	"	150	"

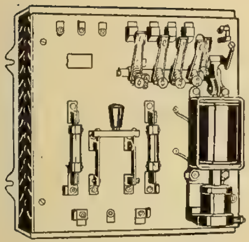
C-H Alternating Current Apparatus

Motor Starters—Manually operated types	8	Bulletins	50	pages
Speed Regulators—Manually operated types	10	"	52	"
Printing Press and Machine Tool Controllers	5	"	20	"
Drum Type Controllers	7	"	34	"
Crane and Hoist Controllers	5	"	20	"
Automatic Starters and Accessories	25	"	90	"
Elevator Controllers and Accessories	41	"	116	"

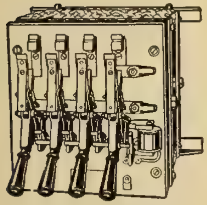
C-H Miscellaneous Apparatus

Theatre Dimmers, Battery Charging Rheostats, Field Rheostats, Push Button Switches, Meter Testing Rheostats, Solenoid Operated Valves, Resistance Units, etc.

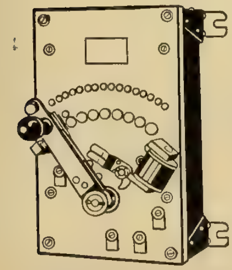
Tell us in what apparatus you are interested at this time and the Cutler-Hammer Messenger Boy will bring you bulletins by return mail.



Automatic Motor Starter. Bulletin 6100



Large Capacity Multiple Switch Motor Starter. Bulletin 2130.



Combined Motor Starter and Regulator. Bulletin 2230.

The Cutler-Hammer Mfg. Co.

Milwaukee, Wisconsin

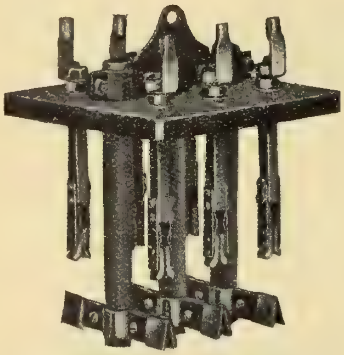
Largest Manufacturers of Motor Controllers in the world

NEW YORK: Hudson Terminal, 50 Church St. CHICAGO: Peoples Gas Bldg.
PITTSBURG: Farmers Bank Building BOSTON: Columbian Life Bldg.
PHILADELPHIA: 1201 Chestnut Street CLEVELAND: Schofield Bldg.
PACIFIC COAST AGENTS: H. B. Squires Co., 579 Howard St., SAN FRANCISCO.
229 Sherlock Bldg., PORTLAND, ORE., and W. B. Palmer, 416 E. 3rd St., LOS ANGELES

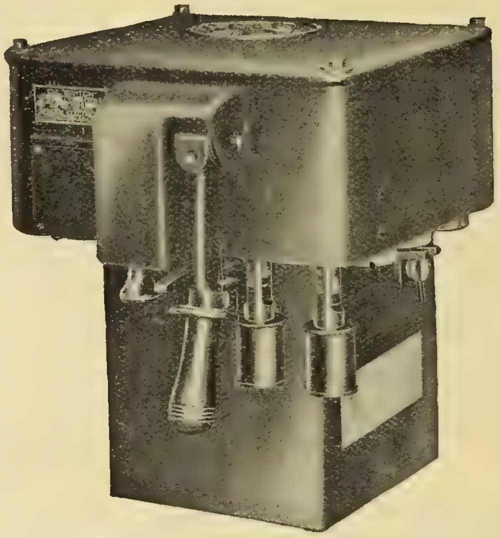
The New K 20 Oil Switch

—What it Means to the Plant

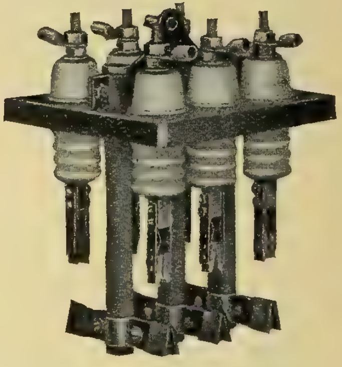
RELIABILITY, SAFETY AND DURABILITY



Contacts, insulation and terminals for 600 volt switch



Type F. Form K-20 Oil Switch complete, with automatic overload and low voltage release



Contacts, insulation and terminals for 2,500 volt switch

The C.G.E. "K-20" Oil Switch was designed specifically to meet the exacting conditions which are experienced in textile and flour mills, woodworking plants, powder works, coal mines, gas works, oil refineries or any industry where there are inflammable materials or explosive gases.

It is **simple, compact** and **durable.**

It is entirely enclosed and perfect in every detail.

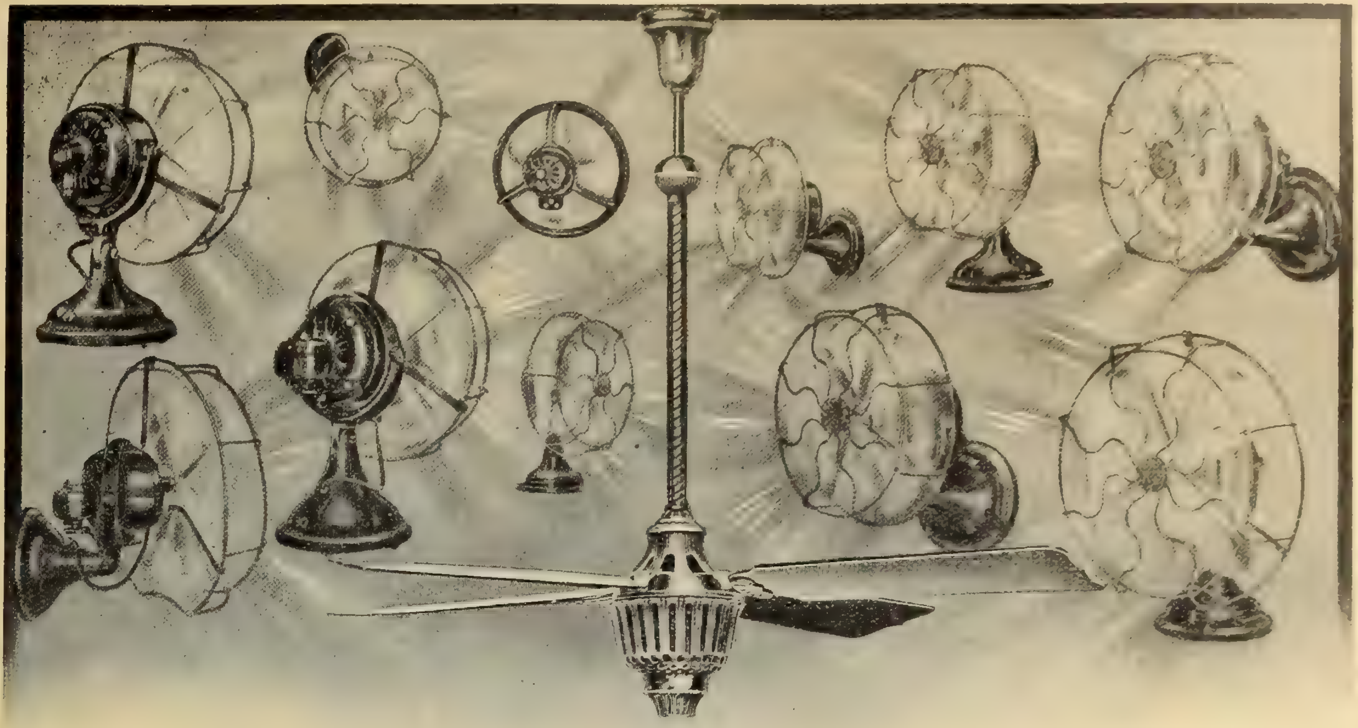
Made in capacities up to 300 amperes and 2,500 volts and can be furnished with different combinations of automatic tripping devices to meet a wide variety of operating requirements.

Complete information and prices are given in Bulletin 4911, a copy of which will be gladly supplied upon request.

Canadian General Electric Co., Limited

Head Office: TORONTO

Montreal Halifax Ottawa Cobalt Porcupine Winnipeg Regina Saskatoon
Calgary Edmonton Vancouver Victoria Nelson Prince Rupert

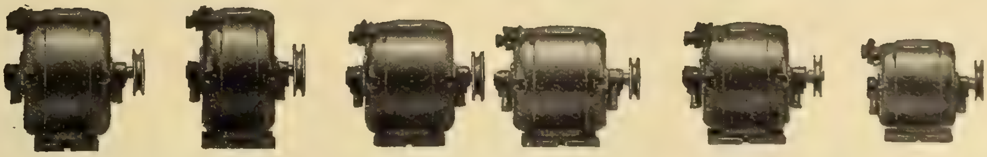


Superior Design **Reliability**

Electric Fans for 1913

Complete in all standard styles and sizes, both alternating and direct current, for residence and commercial uses.

Small Power Motors



C. G. E. Drawn Shell Small Power Motors are unique in the simplicity and compactness of their design. Hundreds of them are in daily use giving perfect service under a wide variety of conditions.

Canadian General Electric Co., Limited

Head Office: TORONTO

Montreal Halifax Ottawa Cobalt Porcupine Winnipeg Regina Saskatoon
Calgary Edmonton Vancouver Victoria Nelson Prince Rupert

What Is A Transformer?

The average electrical man answering this question would naturally reply that, "a transformer is a device to step current up or down from one voltage to another."

Speaking from a technically electrical standpoint, that answer, of course, would be correct. But in actual practical service a transformer must do a good deal more than that.

To be efficient it must perform its function of changing voltage with the least possible loss for its own operation.

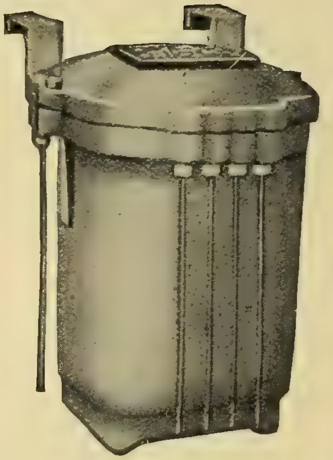
As a matter of fact, a transformer can be fairly compared to a generator. Both are used as a mechanism for the production and delivery of a specified quality of current in a specified quantity.

You would not for a moment consider the purchase of a generator, the operation of which wasted a considerable percentage of the net current which it is supposed to deliver.

Now there are differences in transformer efficiency just as there are differences in generator efficiency.

If all you want in your transformers is to have them transform the voltage as necessary without regard to the cost of operation, any kind of a transformer will probably do.

If you want transformers which will do this work with the minimum amount of loss of power in operation, you will find it worth your while to fully investigate the performance records and service data of



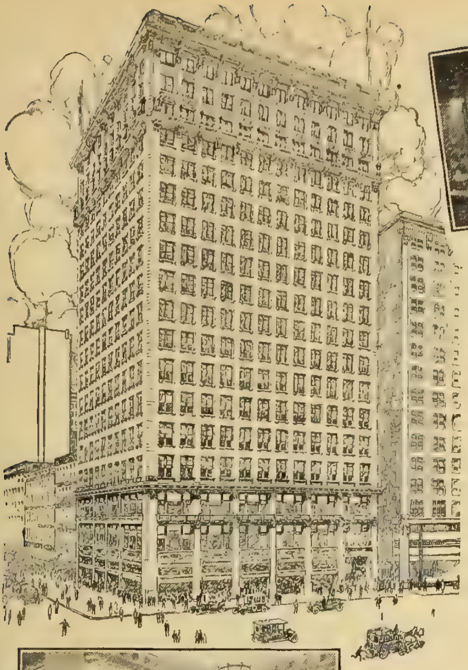
Moloney High Efficiency Transformers

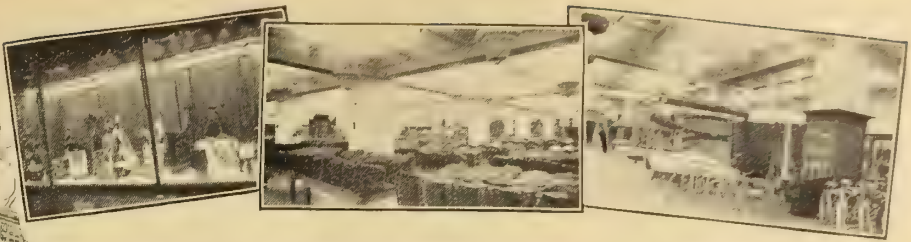
We will be glad to put these data before you at your request.

Canadian Moloney Electric Co., Ltd.

Office and Works: WINDSOR, ONT.

COMPLETE STOCKS
WINDSOR WINNIPEG VANCOUVER





The New Home of "The Hub"

The world's largest men's store is equipped
with

The Eye Comfort Lighting System

746 fixtures are used in illuminating the six floors and basement of this great store.

Eye Comfort Lighting was adopted after a thorough test of practically every system of illumination. These points were given chief consideration: design, advertising value, first impression, cost, current consumption, cost of maintenance and depreciation.

The real deciding factor was the fact that Eye Comfort Lighting does not distract attention to the light sources themselves, but focuses attention upon the merchandise.

On the first floor the indirect fixtures are varied by the use of illuminated bowls of colored glass (see diagram). A frosted bulb furnishes the light for bowl. It is only 6 per cent. of total light generated. This type of bowl is for ornament only and must never be brighter than the ceiling.

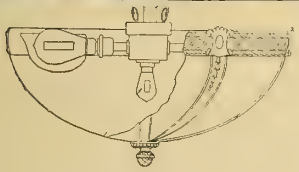
The windows are illuminated by National X-Ray show window reflectors—the only line designed specially for window lighting.

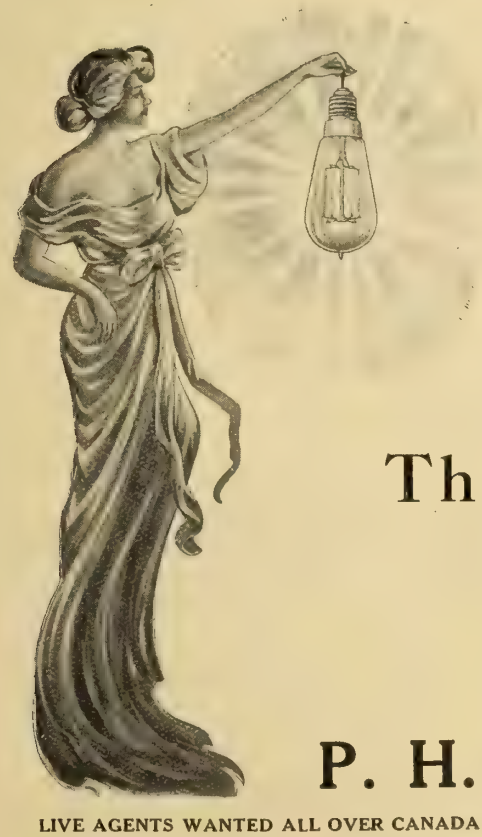
Your Lighting Problems

will be best solved by Eye Comfort Lighting. Send us the blue prints of buildings on which you're figuring for an engineering report. This service will cost you nothing.

National X-Ray Reflector Company

CHICAGO—225 W. Jackson Blvd. **NEW YORK—14 West 33rd St.**





NEWTYPE BERGMANN LAMPS

(*Tungsten Filament*)

The Unbreakable Kind

Are Now Ready for Delivery

We guarantee delivery to you in good condition

EXCLUSIVE CANADIAN DISTRIBUTORS

P. H. KLEIN CO.,
LIMITED

329 CRAIG STREET WEST
MONTREAL, P.Q.

LIVE AGENTS WANTED ALL OVER CANADA

Use

Moonstone Glass

for all kinds of

Illumination

The Jefferson Glass Company
Limited

MADE IN CANADA

TORONTO CANADA

NOTICE AND WARNING

DISK STRAIN INSULATORS

April 14th, 1913.

The Court of Appeals of the District of Columbia on April 7th, 1913, handed down its decision affirming the decision of the Commissioner of Patents, dated August 6th, 1912, which decision awarded priority of invention of the subject matter of United States Patent No. 904,370, November 17, 1908, to me.

This patent is basic and covers disk strain insulators provided with protective parts.

The suit in which the rights of the aforesaid Letters Patent were secured to me by this decision of the Court of Appeals was against a Company which has vigorously contested it for almost three years.

This decision being final, there is no appeal

Suits are about to be brought by me against well-known concerns that are infringing this patent, and will be prosecuted vigorously with a view to securing injunctions and orders for accounting for profits and damages, with reference to the sale of their infringing insulators.

It is my intention also to bring suits against others who are manufacturing, selling and using insulators infringing this patent and thereby violating my rights.

While the patent above recited covers the described type of insulator broadly and fundamentally, I take this opportunity to notify the public at large, and more particularly those who have been infringing certain others of my patents covering insulator constructions, that I intend to enforce to the utmost all of the rights secured to me by and under said patents. Said patents being as follows:

CANADIAN PATENTS:

No. 104,787—April 16, 1907
No. 105,551—May 28, 1907
No. 107,953—Oct. 15, 1907
No. 124,063—Feb. 22, 1910
No. 124,501—Mar. 15, 1910

UNITED STATES PATENTS:

No. 913,439—Feb 23, 1909
No. 927,187—July 6, 1909
No. 905,014—Nov. 24, 1908
No. 839,665—Dec. 25, 1906
No. 859,703—July 9, 1907
No. 927,186—July 6, 1909
No. 853,745—May 14, 1907
No. 844,208—Feb. 12, 1907

Manufacturers are hereby warned against making or selling Disk Strain Insulators, covered by my Letters Patent, No. 904,370, November 17, 1908, as well as the other patents aforementioned, unless duly licensed by me.

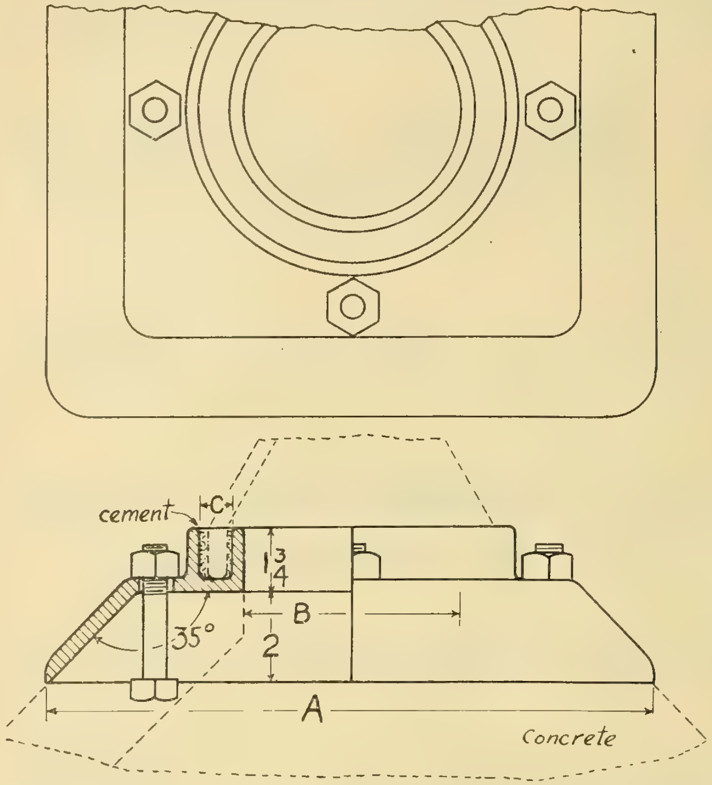
Dealers and users of insulators as well as the public generally, are also notified of my rights under the aforementioned patents, and warned against buying, selling or using such insulators, except from the Electrose Manufacturing Company, or other duly licensed manufacturers.

This notice is given to the end that all may be fully advised in the premises.

CHARLES H. WILSON,
Patent Attorney,
2 Rector Street,
New York, N. Y.

LOUIS STEINBERGER,
President and General Manager,
Electrose Manufacturing Company,
Brooklyn, N. Y.

THE INSULATOR BOOK



Bases for Roof Insulators

The iron bases for roof insulators considerably simplify the installation of our roof insulators as well as insuring more reliable support than is possible when setting the insulator directly on the concrete.

These bases are made in three sizes to receive our roof insulators of 9", 14" and 20" diameters.

The Locke Insulator Mfg. Co.
OR
Engineering Equipment and Supply Co.
410 St. James St., Montreal, Que.

The West's Greatest Electrical Supply House

Ornamental Lighting Standards

Manufactured by the King Foundry Co., St. Josephs, Mich.

Latest Designs Excellent Finish

The "Century Single Phase Motors"

Adaptable to 110 and 220 Volt

Hundreds in use in Western Canada and everyone giving satisfaction. They take care of the small power requirements perfectly

The Famous "THOR" and "RED ELECTRIC"

Hurley Washing Machines

Over twenty thousand giving satisfaction in twenty thousand homes

"Appleton" Unilets

The latest improved conduit fitting, made in all styles for all purposes. Once acquainted with these fittings, and you use them always. They are roomy and save time. Complete stock always on hand.

The Mainer Electric Company, Limited

Winnipeg, Man.

You Can Save Money
By Installing
J-M Fibre Conduit
"The Conduit You'll Eventually Buy"

The Southern California Edison Co., of Los Angeles, Cal., installing 50,000 feet of 3½-inch Style "J" J-M Fibre Conduit on North Los Angeles St., running underground from East Fourth St. to the Plaza 15,000-volt cables to be used.

Present day engineering practice requires waterproof ducts in underground systems of distribution.

In addition to being waterproof, J-M Fibre Conduit is light in weight, thereby reducing the cost of freight, handling, hauling and installing.

Has a smooth bore and eliminates abrasions of the cable sheath.

Affords best protection to the cables from stray currents and electrolytic action.

Furnished in socket, drive, sleeve and screw joint, together with fittings and bends to meet all conditions of service. Standard tubes two inches to four inches in diameter; fifty-four inches and sixty inches long.

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TORONTO MONTREAL WINNIPEG VANCOUVER

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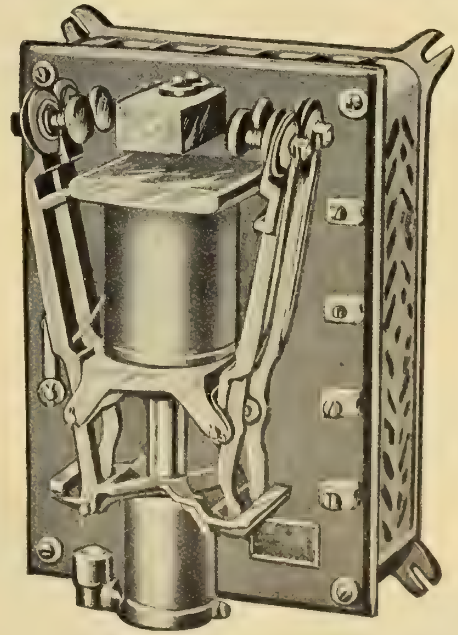
Compact and reliable starter for Direct Current. No sliding contacts.

The advantages of this type of construction are not only simplicity and easy replacement of wearing parts, but also the elimination of sliding contacts which cause trouble due to arcing and consequent sticking of the moving member.

The construction of the Sundh Automatic Starter is compact and simple, consisting of a solenoid, a plunger with retarding dash-pot, and two or more levers hinged to the lower pole-piece of the solenoid.

Send for illustrated Catalogue on Electrical Controlling Devices



The upper ends of the levers carry the contacts. The levers are controlled by their lower ends passing through a frame which is attached to the bottom of the plunger. The contacts are of copper and carbon, and all wearing parts are accessible and easily replaced. For heavy duty the final contact is made by a laminated copper brush. This copper brush, however, does not cut out any resistance, but merely short-circuits the carbon contacts which do cut out the resistance.

SUNDH ELECTRIC CO., - - - NEW YORK, U.S.A.

Represented by C. H. L. Keeler Co., Ltd., Toronto, Canada

Nº115

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TRADE MARK.

Artistic and Attractive Designs in

Lighting Fixtures

"Banner" Electric Fixtures embody all the popular and most up-to-date designs together with many of our exclusive creations.

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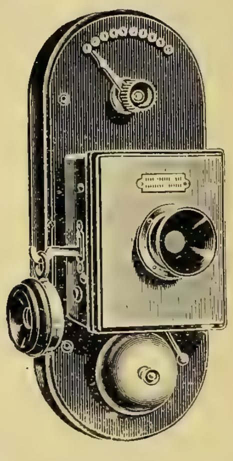
116-118 Richmond St. W., Toronto
SASKATCHEWAN—The Northwestern
Electric Ltd.
Scarth Street, Regina
BRITISH COLUMBIA.—Cope & Son Ltd.
Water Street, Vancouver
ALRERTA.—General Supplies Ltd,
122 Eleventh Ave. W., Calgary

QUEBEC.—Stocks kept by:-Dawson & Co., Ltd., Montreal. Mechanics Supply Co., St. Paul, Quebec.

NOVA SCOTIA.—Stocks kept by:—John Starr, Son & Co. Ltd., Halifax.

NEW BRUNSWICK.—Stocks kept by:—St. John Railway, Dock Street.



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Practical
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Cheap

STERLING TELEPHONES

BRITISH MADE

Lamp Supply

The Lamp supply in every city and town is a large and important item in the business of every central station and supply house. The popular demand is steadily growing for

MAZDA SUNBEAM LAMPS

Carry a complete stock of these Lamps in all their various sizes and styles, and increased business will be the inevitable result.

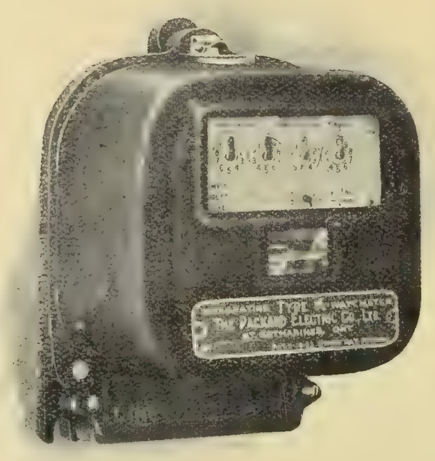
Carried in stock by all dealers or write us for prices and literature.

Made in Canada by

Canadian Sunbeam Lamp Co., Ltd.

Main Office and Factory: TORONTO

Branch Warehouses: MONTREAL WINNIPEG CALGARY VANCOUVER



Metal Case Type K

Polyphase Type PK

Meter Logic

So much depends upon the accuracy and reliability of your meters that you cannot afford to install anything but the **tried** and **tested** variety. Derangement or inaccuracy of the instruments means either a loss of dollars to you or dissatisfaction to your customers. **Both of these conditions must be avoided.**

"PACKARD" Meters

are known throughout Canada and acknowledged by electrical men who know, as the standard for accuracy, reliability and permanence.

The Packard Company was the first company in Canada to manufacture induction meters. The acute importance of the watthour meter was recognized at the beginning, both from the standpoint of the central station and the customer, and every care has been taken to insure "Packard" Meters against the slightest defect.

Large stock carried at

St. Catharines and Winnipeg

St. John Railway Co.,
St. John, N.B.

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Calgary, Alta.

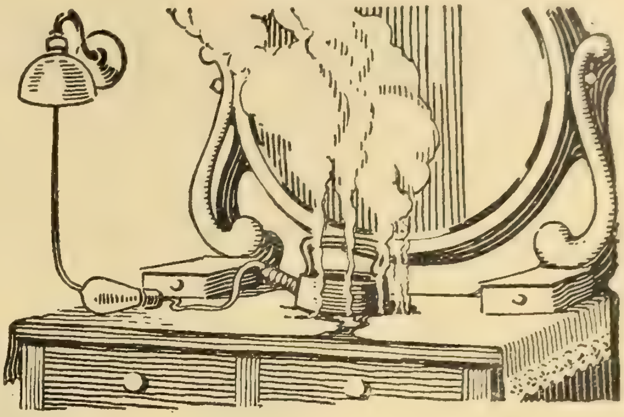
The Packard Electric Company, Limited

Factory at ST. CATHARINES, ONTARIO

General Sales Office
901-2 Traders Bank, TORONTO

N. W. Office and Warehouse
WINNIPEG, MAN.

Many Fires Have Started This Way



A guest at a hotel takes a lamp out of a socket, attaches an electric iron or other heating device, and leaves the room with the current on.

The result is usually a fire, or at the very least a scorching of the dresser, blowing of fuse, etc.

Such fire hazard, not to mention theft of the lamps, etc., can be absolutely prevented by use of the

Shurlok

"The socket that locks"

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Carried in Canada by the jobbers listed below who will gladly give you further information and give you the names of Canadian installations. For free booklet use the coupon.

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Please send free copy Shurlok booklet and Catalog 29.
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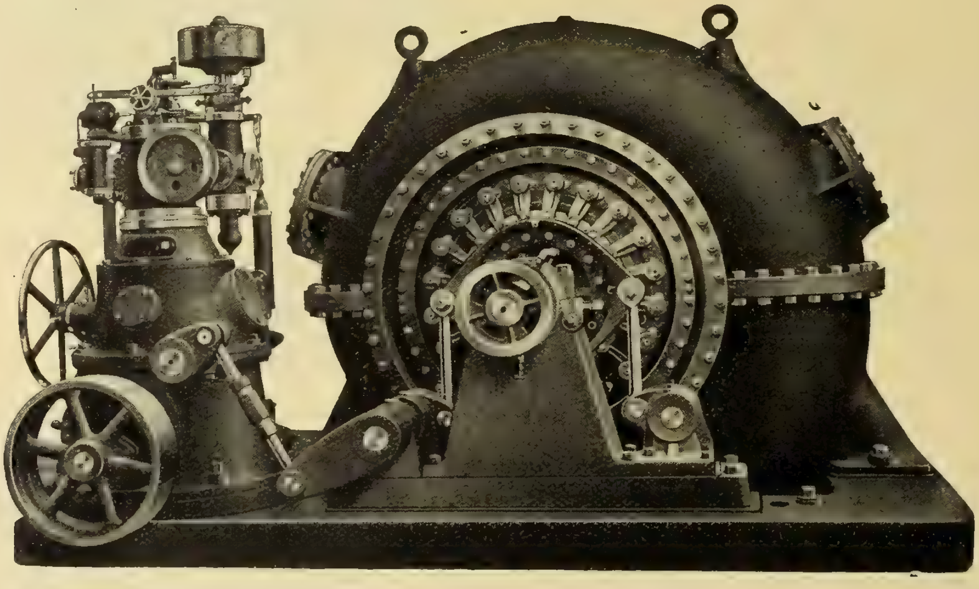
SPECIALLY DESIGNED and BUILT FOR CONNECTION WITH ELECTRIC GENERATORS



Turbine and Oil Pressure Governor

1600 H. P. 375 R. P. M. 155 Ft. Head

Our Oil Pressure Governor is the most powerful but the most sensitive on the market. It gives the best results with either large or small turbines operating under any possible conditions.

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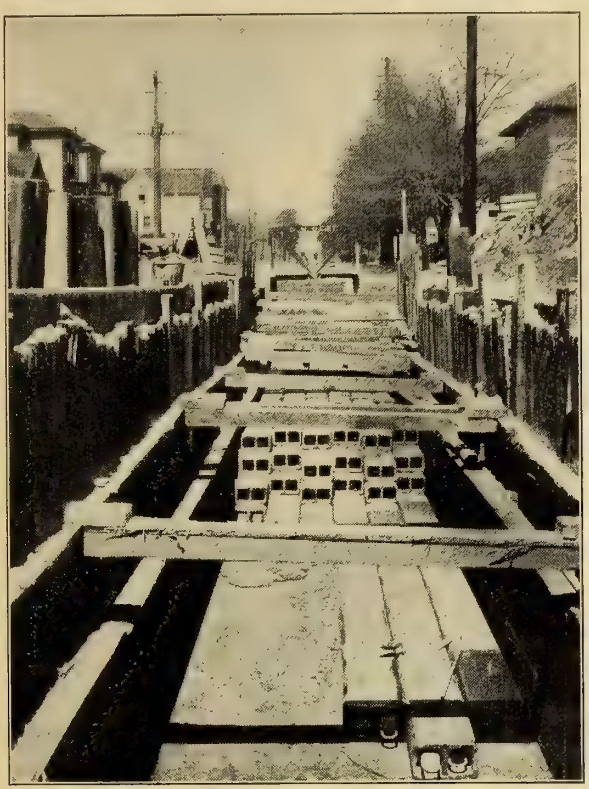
G. M. GEST

Conduit Engineer
and Contractor



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When **G. M. GEST** designs and constructs your Conduit System you receive the benefit of many years' experience and specializing in that line of work.

Power Building, Montreal, P.Q.

The design of

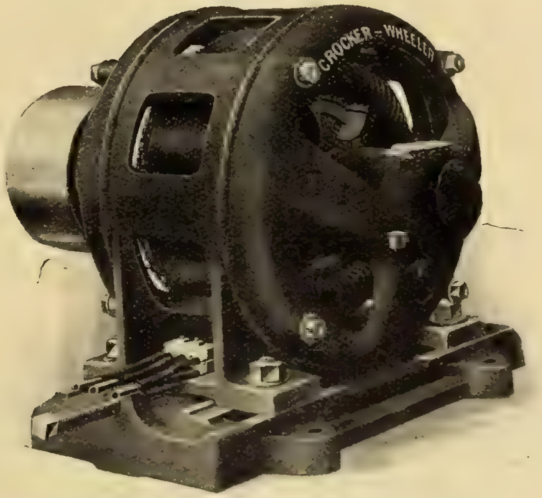
Crocker-Wheeler Induction Motors

includes

Large Shafts

Ideal End-Ring Construction

They have many other desirable features



Crocker-Wheeler Induction Motor. Sizes from ½ H.P. up

Lumen Bearings

Strong Stator Frame

Bulletin 135 describes them

The Canadian Crocker-Wheeler Co., Limited

Manufacturers and Electrical Engineers

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Branch Offices:
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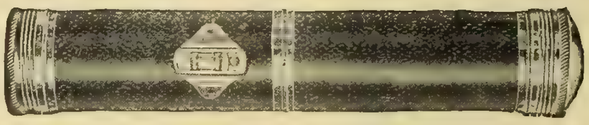

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Your letting a lot of profitable business get past you if you're not handling Eveready Flashlights.

This is one line that you can sell to all ages and conditions of your trade.
Men want them—hunters, motorists, canoeists, and campers—for business purposes too.

Women who are timid about going about a dark house alone want them. Old ladies who have to go out at night want them.

Children delight to play with them, and parents know that this "fire" can be played with in safety.

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Manufacturer and Distributor of Telephone and Fire Alarm Apparatus and Electrical Supplies for every possible need

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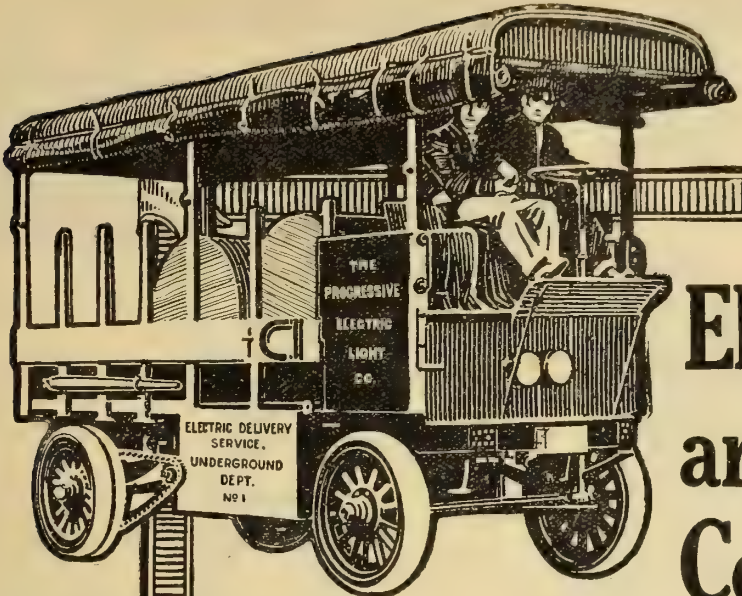
REGINA CALGARY EDMONTON VANCOUVER


THE PROGRESSIVE ELECTRIC LIGHT CO.
ELECTRIC DELIVERY SERVICE. UNDERGROUND DEPT. No 1

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—most efficient and most economical

The Central Station that does not use Electric Trucks is overlooking a big factor for its own betterment. Electric Trucks are most perfectly adapted to the outdoor work of electric lighting companies. They are power plants on wheels—ready always to do their work cheaper, better and quicker than any other type of vehicle. Here are some of the uses to which any Central station can adopt Electric Trucks:

1. **General hauling of all kinds.**
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3. **The application of the electric vehicle in the construction of aerial lines, where electrically operated cranes are used for erecting or removing poles, transformers, etc.**
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5. **The use of electric tower wagon for trimming of arc lamps, etc.**
6. **The adaptability of electric vehicle as an advertising medium.**

Small electric wagons are used by many companies for the delivery of lamps, meters, etc. These wagons are equipped with crates, etc., and have excellent advertising value as well as giving efficient, economical service.

Your use of Electric Trucks recommends them to others

Of course, you know the value of a vehicle charging business in making off-peak hours profitable. Why not boost Electric Vehicles with this end in view?

Once the vehicle users in your locality see that you have confidence in Electric Commercial Vehicles, it will be easy to induce them to follow your lead.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA

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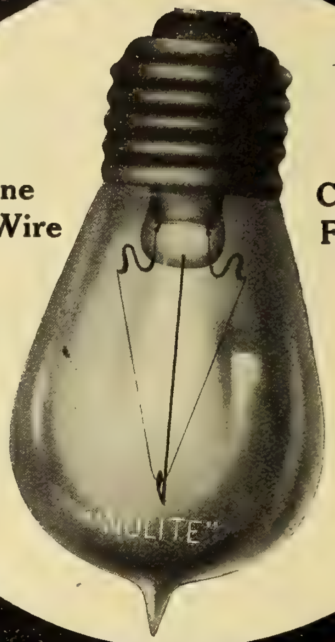
"NULITE"

TUNGSTEN SIGN LAMPS



Genuine Drawn Wire

Continuous Filament

Here is the Lamp with a Record

LOOK!

12 volt 5 watt Drawn Wire Sign Tungsten Lamp

"The Acme of Perfection" is the only term which applies to the "NULITE" Sign Lamp.

It is manufactured with the same exacting care and attention as all our other "NULITE" Tungstens, which insures you of entire satisfaction.

SIGN MANUFACTURERS

Equip all your signs with "NULITE" 12 volt 5 watt Sign Lamps, and enjoy the reputation these lamps are bound to bring.

The tremendous quantity of these lamps ordered are proof of their superiority.

Note the scientific construction, you will see at a glance that it is built to stand maximum vibration set in any position.

We put four of our 12 volt 5 watt lamps on our test rack and burnt them for 18 hours at a pressure of 20 volts, and after critical microscopic examination, failed to find any defect.

Use the Lamp with a Record "NULITE" a Canadian Product Manufactured by

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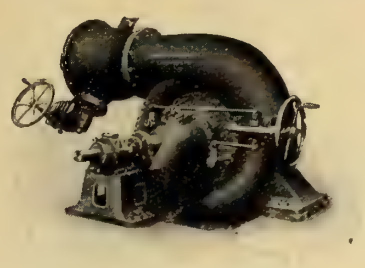

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1000 B.H.P. 120 Feet Fall

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"We purchased a number of your extruded trolley ears during 1911, part of which we used in construction, and have found them entirely satisfactory in every respect. In fact I consider this to be the best trolley ear for grooved wire that I have had any experience with."

"Regarding 12" extruded trolley ears, for 2-0 wire, would say we have found these very satisfactory. I enclosed you an order for 1000 more, which speaks for itself."

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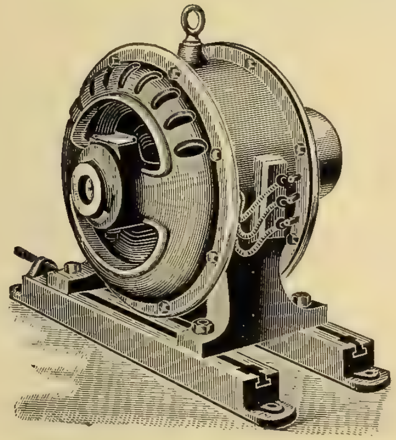
Use Good Motors

to drive your factory.



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Have you any repairs? Write us.

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Power Transmission Line Patrolman's Portable Phone

Weight only 6½ lbs.
Dimensions only 5" x 5" x 5½"

Strong and Durable.
Corners Dovetailed and reinforced.
Receiver-Transmitter and Crank practically flush with the case.
Equipped with cord, Williams test clips and carrying strap as shown.

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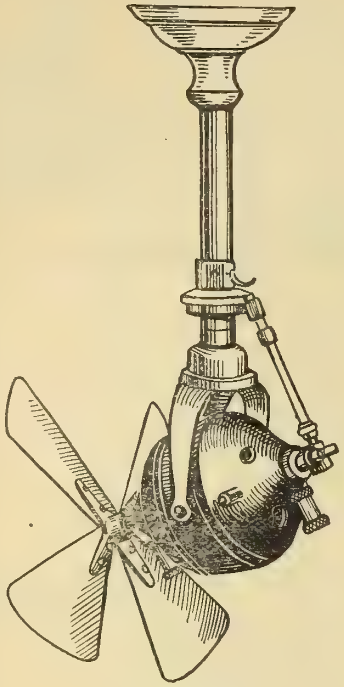

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The Fan Season is Now Here

FANS LEAD ALL OTHERS

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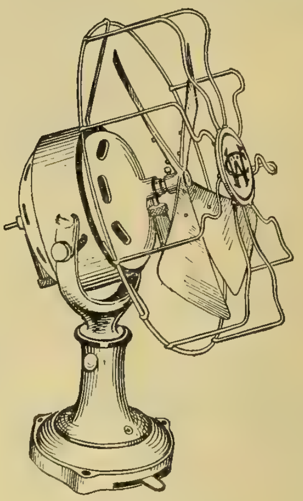
C & W oscillating fans are the neatest and most perfect on the market.

C & W Self Rotating ceiling fans are much superior to anything heretofore offered.

You will be asked for C & W Fans.

Write us for catalogue and prices



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Protection from Lightning Troubles

The following list of users of the Mosciki System of Lightning Protection speaks for itself;

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Lightning, if unchecked, will break the windings of your apparatus, blow out your fuses and break down your transformers.

In short, lack of adequate and capable lightning protection may mean to you serious loss of time, money, and perhaps lives.

A host of so-called lightning arresters are on the market, but 99 per cent. of them are valueless because the principle on which they are constructed is wrong.

High frequency—not high voltage—is the cause of the damage done by lightning.

Most protective systems work on the principle that high voltage is the cause of the damage. This is incorrect, hence their uselessness.

A lightning protection apparatus to be of any use **must offer a clear path to earth for high frequency currents independent of voltage.**

The MOSCIKI System of Lightning Protection fulfills this condition absolutely—it's principle is correct—its design the best and its guarantee absolute. Write us for fuller particulars.

Mosciki Lightning Arrester

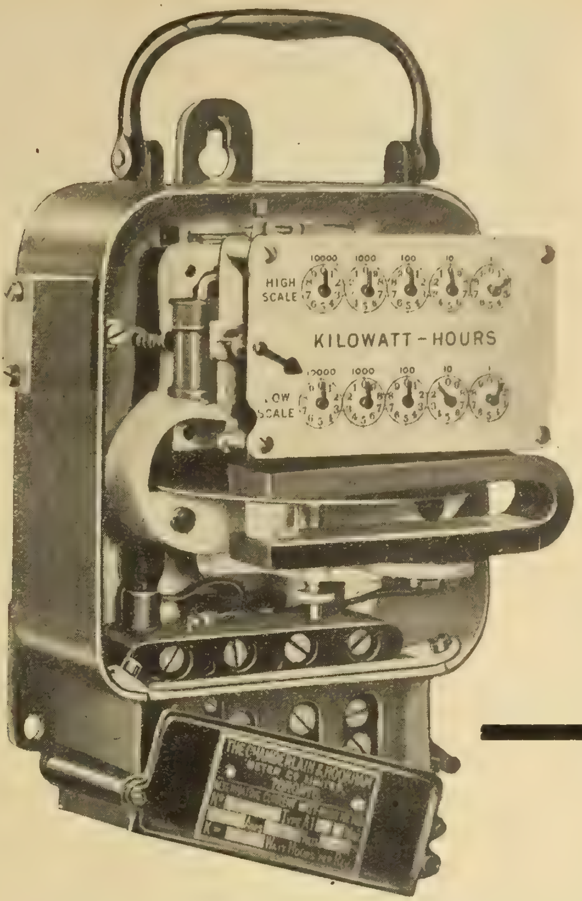
Exclusive Canadian Agents

CHAPMAN & WALKER, ELECTRICAL ENGINEERS AND CONTRACTORS

116-118 Richmond Street W., TORONTO

Two-Rate Meter

Single, Two or Three Phase Circuits



Meter Efficiency and Profits

go hand in hand. Without the former you cannot obtain the latter. If your meter is not doing its work properly your profits will fall short—to make it concise and putting it in two words, you are **losing money.**

If your meters are not giving satisfaction you are going to replace them with meters that will, aren't you?

C. & H. Meters

have demonstrated their efficiency to the complete satisfaction of hundreds of constant users.

They have a higher torque and a higher ratio of torque to weight than any other A.C. meter on the market. They start under a much lighter load than most meters and are very accurate under heavy loads of long duration.

A large stock of A.C. meters, Three-phase meters, Two-rate meters and Prepayment meters is carried at our new warerooms at 120 Richmond Street West, Toronto.

Write for further particulars and arrange for an actual demonstration of C. & H. Meters on your own circuits.

We are meter and time switch specialists

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A large and varied stock carried at our Winnipeg warehouse including

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- Conduits
- Conduit Fittings and Boxes
- Switches
- Fuses
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- Telephones
- Bells and Fire Alarms
- Dry Cells
- Secondary Batteries
- Heating and Cooking Devices
- Electric Motors
- Electric Meters

OUR ENDEAVOR

is to ship standard supplies the day order is received

This Is The Way You Can Get Every Garton-Daniels A. C. Lightning Arrester

After This—What?

You may ask—"Will Garton-Daniels Lightning Arresters do exactly as claimed for them; will they protect my electrical apparatus; will they eliminate surges, low voltages, winking lights and other voltage disturbances on my circuits at the time they discharge; will they eliminate lightning arrester grounds and short-circuits."

Here Is The Proof—

"All Garton-Daniels Alternating Current Lightning Arresters sold either by this Company, or by any electrical jobber, are **Guaranteed Unconditionally** for one year from date of sale. **If for any reason whatsoever** they prove unsatisfactory during that time, they may be returned to the Electric Service Supplies Company's Factory, 17th and Cambria streets, Philadelphia, where they will be either repaired or replaced free of charge, or the entire purchase price refunded, at the discretion of customer."

This is the way you can buy every Garton-Daniels A. C. Lightning Arrester. Will it pay you to delay? **Can you afford to** when you can get "The Complete Arrester" **unconditionally guaranteed** for a year either from us or from jobbers generally throughout the world?

JOHN MILLEN & SON, LIMITED
Canadian Distributors
TORONTO MONTREAL WINNIPEG VANCOUVER

ELECTRIC SERVICE SUPPLIES CO.
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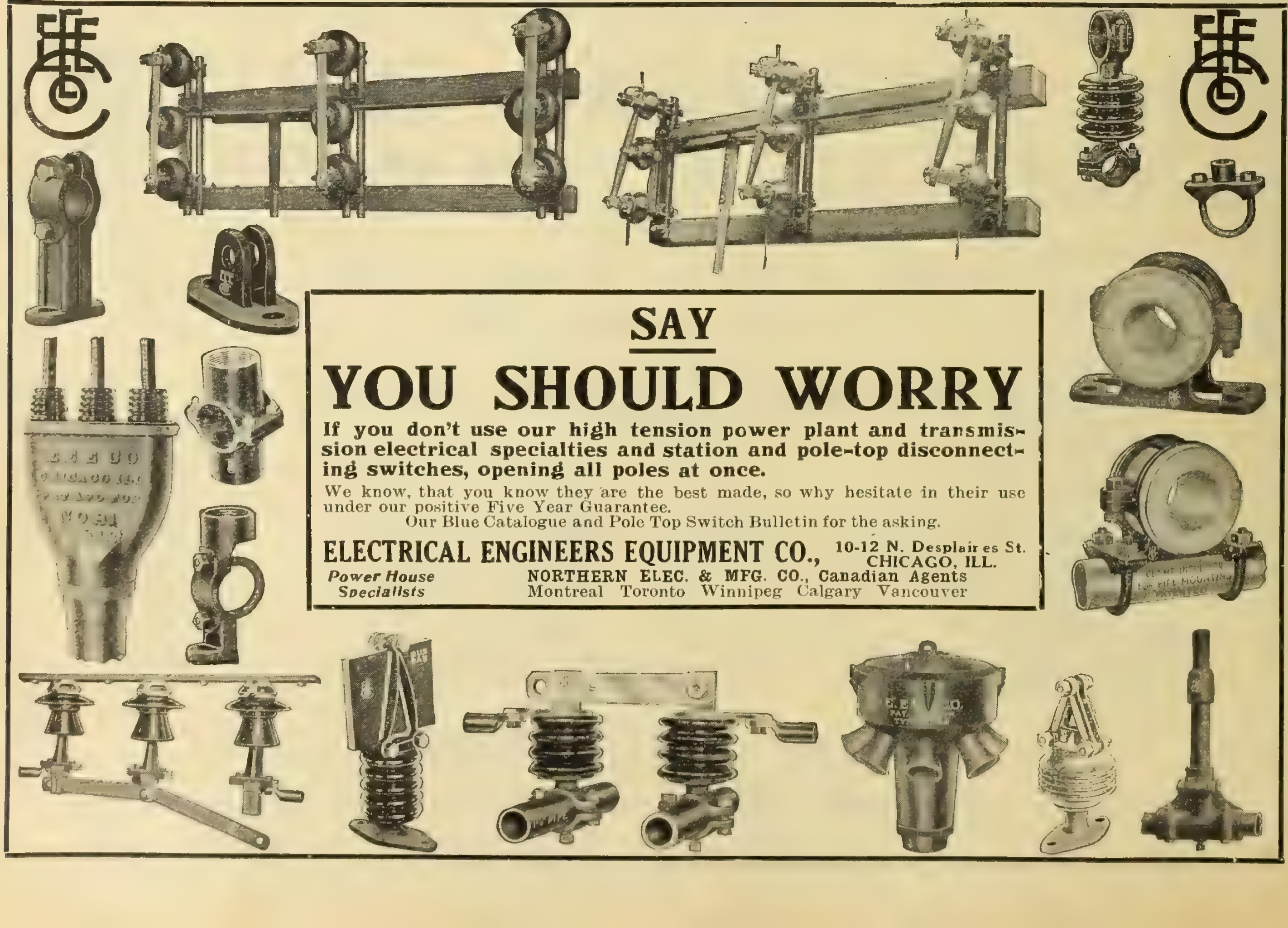

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If you don't use our high tension power plant and transmission electrical specialties and station and pole-top disconnecting switches, opening all poles at once.

We know, that you know they are the best made, so why hesitate in their use under our positive Five Year Guarantee.
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Vol. 22 **Toronto, May 1, 1913** **No. 9**

Electric Vehicle Publicity

The Electric Vehicle Association of America was formed a little over a year ago for the purpose of placing the merits of electric vehicles before the interests most nearly concerned. These included central stations and manufacturers not only of electric vehicles themselves, but of any kind of product in which an electric vehicle could be used in transportation work. It is the intention of this association to bring to the attention of central stations the value of the business which comes from charging storage batteries used by electric vehicles. This business not only represents an extension to their trade, but what is often of much greater importance, it represents a customer that can be supplied at a time when the plant is running very low. Indeed most of the electric vehicle charging business is done during the night when practically every other consumer is off the line.

The Association has also endeavored to bring to the attention of the manufacturer or other organizations requiring transportation facilities, the advantages that storage battery vehicles possess over horse drawn, or even gasoline. It has been shown that more work can be done in less time, and at less expense, and the result has undoubtedly been that the situation with regard to the electric vehicle business is much more prosperous than it was twelve months ago.

As this organization may be considered a philanthropic one, it has been dependent for the defrayal of its operating expense on private subscriptions. The list of contributors include, principally, manufacturers of electric vehicles, who profit directly by the publicity given their product by the Association, and central stations who profit indirectly by the increased load resulting from the greater use of the storage battery. With the beginning of the second year of this association's operations it now becomes necessary to make an appeal for further contributions, and letters are being sent out to three classes—first, to those who contributed to last year's campaign fund; second, to manufacturers who did not contribute to last year's fund, and third, to central stations who did not contribute last year. In these letters it is pointed out what the value of the advertising carried on by this association has meant to the industries during the past year. It is stated that inquiries have been received from every state in the United States and from more than twenty-five outside countries. The letters further state that the scope of the campaign literature will now be extended, and whereas in the past this has been almost purely educational, the second year's campaign literature will make the matter more specific, and by giving facts, figures and data with respect to the electric vehicle will make a direct appeal to the purchaser. Two booklets will be issued during the present year, one entitled "The Story of the Electric Commercial Vehicle," the other "The Story of the Electric Pleasure Vehicle," which will each be published in attractive form.

Attention is especially drawn to the splendid results obtained by the past year's advertising, but it is pointed out that the foundation work only has been done. While the public are beginning to appreciate the value of the electric vehicle, it is absolutely necessary that the work of education must be continued without intermission, so that the foundation already laid may not become valueless. A strong plea, therefore, is made for sufficient funds to carry on this work during the present year.

The Electric Motor

In this issue we have made an attempt, in an article of some length, to cover, in a general way, the field of the use of electric motors. We make no claim to discovering applications of motors that were not fully recognized before, but we believe this is the first attempt that has been made to assemble, as it were, the various parts of the motor-driven industry, which, taken together, form the basis of 20th century progress. We are free to admit, however, that though we have devoted some seventeen pages to this subject, much has remained unsaid that would naturally have found space in such an article.

Still, the simple fact that seventeen pages is insufficient to do much more than touch the fringe of this subject, is indicative of the already widespread application of electric motors. The article, incomplete though it is, has gone far enough to prove to the most sceptical that there is no industry nor any phase of any industry that cannot be served efficiently and economically by electric drive.

Fire Prevention Device

The Fire Prevention Company of Canada, Limited, Montreal, propose to put on the market a device invented by Mr. L. T. Reichel, formerly chief electrical engineer for the New Zealand Government, and now in use in that country and in Great Britain. The device is the adaptation of an old principle, and it is claimed to be both fool proof and trouble proof and free from false alarms. Small thermopiles, containing dissimilar metals, are placed on the walls or ceilings, one to each one hundred square feet of space, and these are connected by means of wires with a sensitive galvanometer, which in turn is connected with a local and central alarm bell, and at the same time indicates the location of the fire. A sudden rise in temperature of four degrees acting upon the exposed ends of the thermopile, generates a sufficient current of electricity to at once automatically set the alarm system in operation. In case of a wire or other part breaking, an automatic signal gives the alarm to the central office, and this signal is persistent until the trouble is put right. The chief feature of the system is the galvanometer, which is used in combination with the ordinary clock work mechanism usual in all fire alarm systems, but another quite important feature is that an alarm can be given by hand in the event of a fire being discovered before it has had time to be automatically recorded. Should a wire break on the street or elsewhere outside of the premises protected by the system, the trouble signal is given to the central station by means of the McCullough system of grounding the current.

The Canadian Fire Underwriters' Association have recognized the system and will allow an appreciable reduction in the rate where the apparatus is installed in commercial premises. Mr. James Bennett is the managing director of the company, who are also putting on to the market a number of other fire preventative appliances.

Cedars Rapids Contract

After doing a portion of the construction themselves, the Cedars Rapids Manufacturing and Power Company have let a contract for the remainder of the work to Messrs. Fraser, Brace & Company, of New York. The cost will be over $3,000,000 and is on a unit price basis. The work already done includes the crib work on the outer bank of the canal, and Messrs Fraser, Brace and Co. will complete the canal and build the power house. Operations were commenced immediately after the signing of the contract, which provides for an initial installation of 100,000 horse power. The hydraulic portion of the scheme is under the direction of Mr. Julian C. Smith, chief engineer of the Shawinigan Water & Power Company, and the installation of the electrical machinery will be under Mr. R. M. Wilson, chief engineer of the Montreal Light, Heat & Power Company. Mr. Charles E. Fraser is a native of Montreal, and a graduate of the Faculty of Applied Science at McGill. He was at one time engaged in journalistic work. His firm carried out a considerable portion of the work on the plant of the Canadian Light & Power Company, St. Timothee, P.Q.

Messrs. Stone & Webster, of Boston, have secured the contract for building the transmission line from Cedars to Messina, N.Y., a distance of about 50 miles, for the Aluminium Company, who have agreed to take a large amount of power from the Cedars company.

Canadian Allis-Chalmers, Limited

Announcement has been made by Mr. Frederic Nicholls, president and general manager of the Canadian General Electric Company, that negotiations are now concluded with the Allis-Chalmers Company of Milwaukee, and the Allis-Chalmers-Bullock Company, of Montreal, by which the Canadian General Electric Company acquires all the properties and assets of the Allis-Chalmers-Bullock Company in Canada. An agreement has also been made with the Milwaukee company, which gives the exclusive right to manufacture and sell in Canada the types of apparatus for which the Allis-Chalmers company have achieved a reputation, such as Corliss engines, water wheels, sawmill machinery, flour mill machinery, mining machinery, cement machinery, gas engines, etc.

The business will be conducted under the name of the "Canadian Allis-Chalmers, Limited," a charter having been applied for. Mr. Milne, manager of the Allis-Chalmers-Bullock Company, will continue as manager of the new company. The Canadian General Electric Company, with its subsidiary companies, the Canada Foundry Company, and the Canadian Allis-Chalmers, are now in a position to build and equip completely any industrial enterprise, as they manufacture the structural steel required for the buildings; Corliss engines, steam turbines or water wheels for the motive power; boilers, pumps, electric cranes and everything else required for the equipment, and sawmill machinery, flour mill machinery, mining or cement machinery for operation.

It has been finally decided to hold the annual convention of the Canadian Electrical Association in Toronto, instead of in Fort William as announced some weeks ago. The date of the convention in Toronto will be June 25, 26 and 27.

Comparative Cost of Delivery by Electric, Gasoline and Horse Power

A paper was recently read before the Electric Vehicle Association of America by Prof. H. F. Thompson of the Massachusetts Institute of Technology on the above subject. Prof. Thompson gave some interesting cost figures comparing the operation of the three types of vehicles, horse-drawn, electric and gasoline, which showed an economy of motor vehicles over horse-drawn trucks. Following are the figures submitted:

	1000 lb. Electric	1000 lb. Gasoline	1 Horse Wagon (2-3 extra horse)
Average running speed, to and from delivery zone, m. p. h.	11	15	6.5
Average running speed in delivery zone	9	9	5
Hours per day for loading	2.0	2.0	2.0
Hours per day to and from delivery zone	1.45	1.1	2.5
Hours per day in delivery zone	5.55	5.9	4.5
Miles per day to and from delivery zone	16	16	16
Miles per day in delivery zone	21	23	13
Miles per day, total	37	39	29
Deliveries per day	128	138	78
Deliveries per mile of total day's travel	3.5	3.5	2.7
Days used per year	285	275	285
Miles per year	10,500	10,500	8,300
Deliveries per year	36,500	37,000	22,000
Expense per year—			
Tires or shoeing	$ 170.00	$ 190.00	$ 60.00
Repairs	300.00	550.00	125.00
Battery	250.00	......	......
Veterinary	......	......	10.00
Lubricants	15.00	50.00	......
Electricity, 3c. per kw. hr.	160.00	......	......
Gasoline at 16c. per gal.	......	215.00	......
Feed	......	......	320.00
Garage or stable	200.00	200.00	125.00
Driver or helper	1,000.00	1,080.00	1,000.00
Depreciation	165.00	305.00	160.00
Interest	60.00	60.00	24.00
Insurance	135.00	170.00	30.00
Total annual expense	$2,455.00	$2,810.00	$1,854.00
Cost per day	8.60	10.40	6.50
Cost per mile	.23	.27	.23
Cost per delivery	.067	.075	.085

Poles and Ties in 1911

The Department of the Interior has just issued a report on poles and cross ties used in Canada during 1911. The report as to ties is based on figures received from 51 steam railways and 33 electric roads. The total number of ties purchased in 1911 was 13,683,770. The average cost was 39c each. The lowest cost being 21c for beech, maple and birch, the highest cost being $1.11 for Southern pine. The total number of ties was made up of the following percentages: Jack pine, 39.9 per cent.; tamarack, 19.3 per cent.; Douglas fir, 14.2 per cent.; hemlock, 12.2 per cent.; spruce, 6.6 per cent.; cedar, 5.3 per cent.; oak, 1.1 per cent.; red pine, 0.5 per cent.; chestnut, 0.5 per cent.; western cedar, 0.4 per cent.; birch, 0.1 per cent.; maple, 0.1 per cent.; beech, white pine, poplar, southern pine, elm, black ash, less than 0.1 per cent. The total number of ties purchased represents an increase of 48.5 per cent. over the previous year. About 63 per cent. of the 1911 ties were hewn as against about 70 per cent. in 1910, indicating an increasing popularity of the sawn tie. Steam railroads used 95 per cent. of all the ties purchased, the number for electric roads being only 585,242. These were made up chiefly of Douglar fir, constituting 55 per cent. and cedar 28 per cent.

During the year 1911 only 206,209 ties received preservative treatment which is about 1.5 per cent. of the total number used.

The statistics of poles purchased in 1911 were obtained from reports from 282 companies made up of 129 electric light and power concerns, 102 telephone companies, 28 electric roads, 19 steam railways and four telegraph companies. These companies were divided into two main classes, first, steam railway, telephone and telegraph; second, electric railways, power and light. This classification seemed best from the fact that steam roads operate telephone and telegraph lines in connection with their railways and many electric roads distribute power and light.

The total number of poles purchased was 585,703 at an average cost of $1.80. The cost of the various kinds of wood were as follows: red pine, $13.16; white pine, $10.70; yellow pine, $9.33; chestnut, $5.25; Douglas fir, $3.79; western cedar, $2.99; hemlock, $1.68; cedar, $1.61; larch, $1.43; spruce, $1.02; jack pine, 89c. Cedar was by far the most generally used, representing about 80 per cent. of the total, with western cedar second and larch third. The use of spruce pole is also increasing, nearly 9,000 being used during the past year.

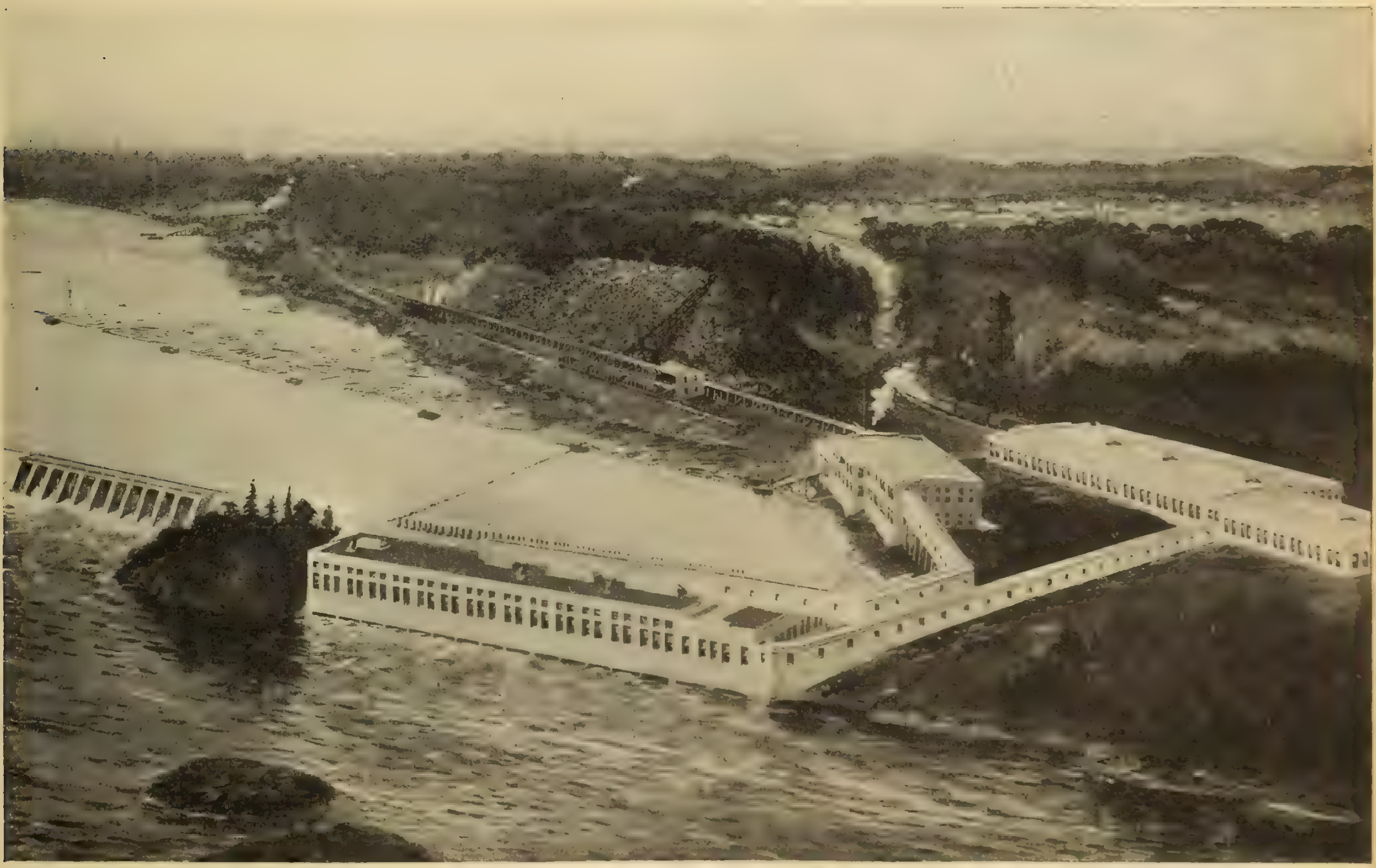
Tables given in the report cover the number of poles, the total cost and the average cost for different lengths of poles. 20 to 25 ft. lengths constitute 58 per cent. of the total and cost on an average, $1.12; 26 to 30 ft. lengths were 17 per cent. of the total and averaged $2.17; 31 to 35 ft. lengths were 3 per cent. of the total and averaged $3.65 each; 36 to 40 ft. lengths were 3 per cent. of the total and cost $4.93 each; 34 ft. and over were 2 per cent. of the total, averaging $8.25 each.

Abitibi Pulp and Paper Mills

Work is now proceeding on the dam and power house of the Abitibi Pulp and Paper Mills, Limited, at Iroquois Falls, Ont. At first a ground wood pulp mill, with a capacity of 180 tons per day, will be constructed; later a chemical pulp plant will be installed, and eventually paper mills will be erected. The company have secured leases of the Iroquois Falls, capable of developing 22,000 horse power at 80 per cent. wheel efficiency; Couchiching Falls, 18,000 horse power; and Twin Falls, 18,000 horse power. At present it is proposed to develop the Iroquois Falls to the extent of 17,500 horse power. Mr. Henry Holgate, who is the consulting electrical engineer, is of opinion that there will be sufficient water all the year for the company's requirements. At present there is a drop of 23 feet at Iroquois Falls, but this will be increased by the contractors to 36 feet. The water will be backed right up to Twin Falls, and up the Black River to Matheson. A branch line of the T. & N. O. Railway is being built, and this will be completed by the end of June.

Of the power to be generated, about 15,000 will be used for running 18 ten-ton grinders, and in addition 3,000 horse power of electrical energy will be utilised. The capacity of the wet machine room will be 200 tons, and in the wood preparing room the slashers will deal with 600 cords per 10 hours, while the barkers will treat some 20 cords per hour. The saw mill will have a daily output of 25,000 feet, and the dry kilns of 7,500 feet per day. A wood working mill, with planers, matchers, etc., also a machine shop fully equipped with lathes, planer and drills have been erected.

The buildings will be completed by December 1st, and



Plant of the Abitibi Pulp & Paper Mills as it will appear when completed operations commenced in January next year. The plant has been designed by Mr. G. F. Hardy of New York, and the contract let to Messrs. Morrow & Beattie.

Record Results

The Western Canada Power Company, in issuing their annual statement for the year ended December 31st, 1912, briefly reviewed the situation of development and distribution since the company commenced operations at the beginning of the year. During the year 1912 the company procured industrial power contracts to the amount of 20,000 h.p., 13,000 of which was actually connected up at date April 10th, 1913. In addition, a contract has been closed for approximately 6,000 h.p. with the Whatcom County Railway and Light Company, under which supply had already been begun. The report states that early in the year a further contract was completed with the British Columbia Electric Railway Company for an increasing supply of electric power up to 40,000 h.p., and that on April 8th they began supplying power on account of this contract. At the commencement of the second year of operation therefore, this company has contracted for a supply of 65,000 h.p. with about 5,000 more under negotiation and the statement is made by the management that they do not believe that any new hydro-electric undertaking, in building up its business in new territory, has ever obtained better results during the first 15 months of operation.

The hydro-electric plant at present comprises two units located at the upper fall on the Stave River, each unit consisting of 13,000 h.p. at the turbine. The rapid increase in business has led the company to outline the following program of extension, which covers the next seven years, by which date they calculate to have a demand of 94,000 h.p. available with which they will be able to take care of a connected load of approximately 150,000 h.p.

	No. of Units	Demand in Horse-Power
1913	2	24,000
1914	3	30,000
1915	4	40,000
1916	5	54,000
1917	5	60,000
1918	6	74,000
1919	7	88,000
1920	8	94,000

The report further states that the plant of 25,000 h.p. capacity which is now in operation at the upper site was originally constructed so that its capacity could be doubled with an expenditure of about $80 for each h.p. of additional less cost per h.p. so that the total bond debt on the entire development. The second plant can be developed at even property will be less than $130 per h.p. including dams, power houses, main transmission lines and power distribution systems for over 10,000 h.p. developed.

The assets of the company are now placed at $8,339,866, against which there is a bond issue of practically $5,000,000 and a common stock isue of $3,000,000. The management of the company are C. H. Cahan, president; T. J. Drummond, Sir Max Aitken, A. R. Doble, A. H. B. MacKenzie, C. Sweeny, Jno. Hendry, William McNeil, R. F. Hayward. Mr. Hayward is also general manager of the company.

Standard Inspection

The British Columbia Electrical Inspection Society is the title of an organization which has lately been formed at Vancouver, composed of city and municipal electricians and inspectors, superintendents and other officials of electrical contracting firms, and representatives of power companies and supply houses. The object of the society is the standardization of inspection work, and the co-operation of the various electrical interests. It covers New Westminster, Burnaby, Point Grey, South Vancouver, and North Vancouver, as well as Vancouver. The first open meeting of the society was held on April 8 and it has been decided to hold bi-monthly meetings from now onward. An address on some interesting electrical subject will be given each month by one of the members.

Mr. C. H. Fletcher, city electrician of Vancouver, has been elected president and the newly elected vice-president and secretary are Messrs. H. Burns and J. W. Cooke respectively, of the City Electrician's department.

It is hoped to later extend the scope of the organization by the addition of members from the cities and municipalities of the interior.

Latest Report on Keokuk Plant

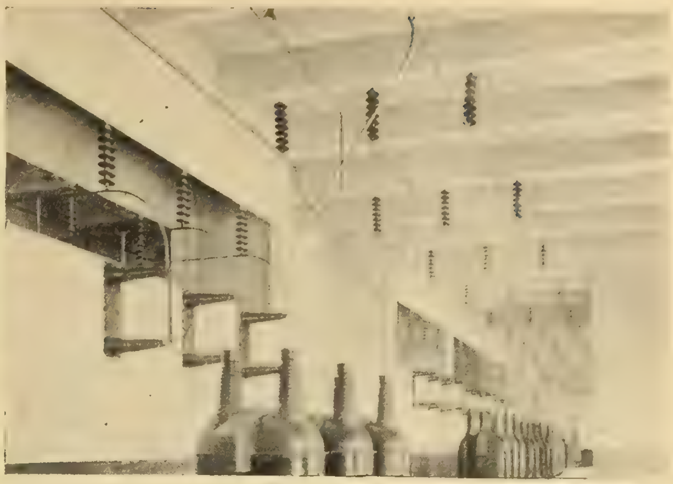
The latest progress report of the Mississippi River Power Company, at Keokuk, Iowa, where thirty 10,000 h.p. water units are being installed indicates that the work is now well under way and that the plant will be turned over to the operating department in June of the present year. The illustrations shown indicate the advanced progress of the work. One of the figures shows a portion of the tail-race, which is now completed, with the draft tube openings. Fig. 2 is a view looking through the low tension bus room of the power house. Fig. 3 is a section of one of the high tension rooms located on the fourth floor of the power house. Fig. 4 shows the steel gates which set on top of the dam spillways. It will be remembered that there are 119 of these gates all operating independently. Fig. 5 is a view of the structures and fittings on top of the power house roof. Fig. 6 shows the towers used on the 110,000 volt line. The similarity between towers used in the Mississippi plant and the towers of the Hydro-electric Power Commission of Ontario, both designed for the same voltages, is very noticeable. The main features of this plant have been outlined in former issues but the following additional data is of interest.

Generators

Four of these units are now entirely completed. The base and stationary portion is assembled for two more and stators are wound for six in addition. The rotating portion is completely assembled for eleven machines. One of the

Portion of tail-race showing draft tube outlets

Low tension bus room



Section of high tension bus structure

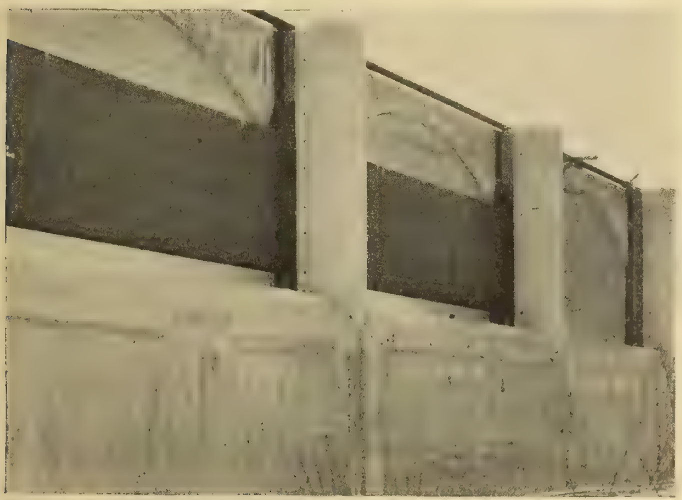
1,000 kw. exciter generators has been erected and connected up.

Transformers

A complete transformer weighs 246,000 lbs., and stands nearly 25 ft. in height. Each transformer is mounted on wheels which rest on hundred pound rails and can be rolled out into the gate room under the crane for repairs. Each transformer has a capacity of 9,000 kv.a. and steps the voltage up from 11,000 to 110,000 volts. Efficiency is 98.2 per cent. Fifty-six gallons of cooling water per minute will be required by each.

H. T. Equipment

The high tension busbars are made of 2 in. iron pipe and are hung from the ceiling by seven-part disc insulators. Immediately below these, are the 110,000 volt oil switches each consisting of three tanks approximately 3 ft. x 6 ft. x 6 ft. The current passes through the roof, through porcelain bushings tested to 330,000 volts. On the roof the current passes through choke coils and air-break switches to the transmission line. Between choke coils and air switches aluminium lightning arresters have been installed.

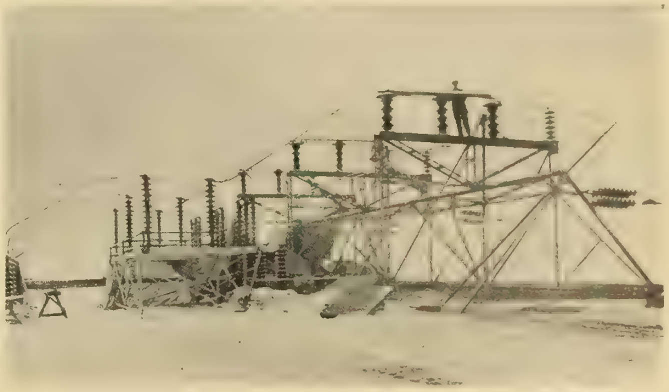


Showing steel gates closing opening above spillway

Transmission Line

The 110,000 volt transmission line to St. Louis is 144 miles long. It runs on a private right-of-way 100 ft. wide crossing the Mississippi River twice and the Missouri once by long spans of special construction.

Towers are of two types, standard and anchor. The standard towers are 79 ft. in total height with a 20 ft. x 20 ft. base, each one weighing 6,800 lbs. Each leg of these towers is bolted to a reinforced concrete foundation extending 6 ft. below the ground level. The anchor towers are 74 ft. in height, 24 ft. by 24 ft. at the base, and weigh 10,500 lbs. They are designed to withstand a total pull of 50,000 lbs. in the direction of the line. The foundations of the anchor towers extend 8 ft. below the ground level. In the standard line construction spans are approximately 800 ft. and anchor towers are used at all angles, on both sides of railway corners and approximately every tenth tower on tangents.



High tension structure on top of power house roof

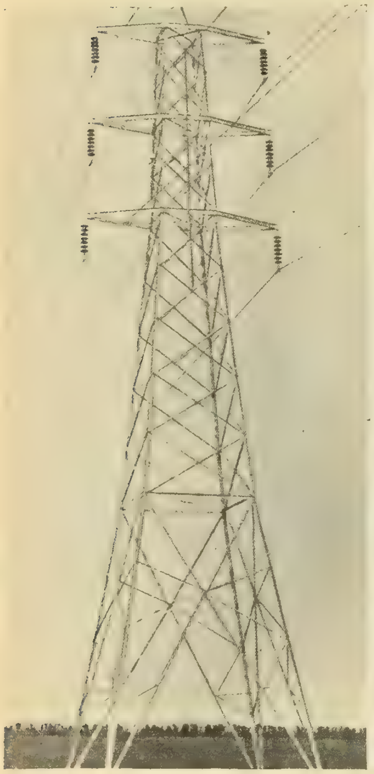
The towers carry seven wires in all. Six, comprising the two transmission circuits are arranged in vertical planes 18 ft. apart on each side of the towers at elevations 50 ft., 60 ft. and 70 ft. above the ground. The seventh is a ground wire mounted at the apex of the tower.

The current conducting wires are composed of nineteen strands of hard drawn copper and are ⅝ in. in diameter with an area of 300,000 c.m. This cable has an ultimate strength of 14,000 lbs. and is strung so that at zero degrees F. with a 60-mile wind and a coating of ½ in. of ice the tension will not be more than 7,065 lbs. The ground wire is a galvanized seven-strand cable, ½ in. in diameter, of Siemens Martin steel. It has an ultimate strength of 11,000 lbs.

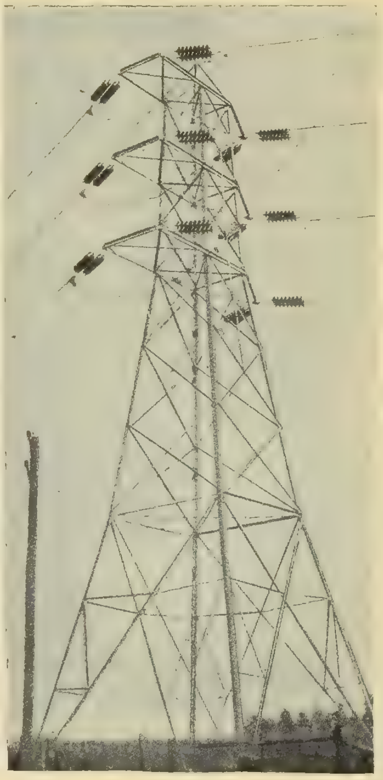
The insulators which support the high voltage conductors consist of seven corrugated porcelain discs each 10 in. in diameter, connected by malleable iron fittings, making a completed insulator unit 3 ft. in length tested to withstand a voltage of 440,000. The insulator is held to the tower and the conductor to the insulator by fittings of open hearth steel. The wire clamp consists of two plates into each of which a wavy groove, flaring at the ends, has been pressed so as to better hold the wire. At anchor towers conductors are dead-ended through two parallel strings of eight units each as shown in one of the illustrations herewith.

The river crossings are made by one or more long spans varying from 2,000 ft. to 3,200 ft. The two circuits are separated at these crossings and each, together with a ground wire, is run on a separate line of towers. These towers vary in height from 60 ft. to 231 ft., and are set on massive concrete foundations resting either on bed rock or on piling.

The conductor used on all of these river spans consists of a ⅝ in. core of special high tension steel with an outer stranding of twenty copper wires, giving a total diameter of ⅞ in. Each circuit has a ground wire the same size as the conductor core. The ultimate strength of the conductors is 52,000 lbs. The special insulators required to hold up these long spans are made up of six strings of standard insulators inter-connected in such a way that the pole is evenly distributed. These insulators have an ultimate strength of 60,000 lbs. The conductors are in general strung to give a minimum clearance over navigable channels of 60 ft. and over other points of 30 ft.



Standard Tower



Special anchor tower

In the erection of the tower line, the towers were assembled complete on the ground and raised on a temporary hinge fastened to two of the foundation piers, by means of a gin pole and a team of horses. When the towers were erected each conductor was strung from one angle tower to the next by hanging pulleys from the angle towers at points where the insulator would ultimately be placed, threading the cable through these and pulling it up for the entire distance between anchor towers. The line was brought to the proper tension by means of a dynamometer and fastened to the dead-end insulators at each end. A stirrup support was then attached at each intermediate tower, the conductor raised from the pulley by it, the pulley removed and the insulator hung and bolted to the cable.

A telephone line parallels the transmission line and is built on 30 ft. cedar poles. There are two No. 8 telephone conductors and a ground wire for lightning protection.

Errors In Transformer Tests

A Discussion of the Principal Sources of Error and the Best Methods of Avoiding Them*

In order to obtain accurate results in making transformer tests, it is necessary to make all measurements and tests very carefully, and to be able to pick out and eliminate all errors or sources of error. Some errors can be avoided, while others are of such a nature that they must necessarily be included in the measurements and can be corrected later. Only those errors or sources of error that have an appreciable effect upon the results should be eliminated, since to include all would be introducing laboratory methods into commercial testing, thus unreasonably increasing the time and cost of making tests without securing any useful results.

Instruments

Instruments should be selected to give a good scale deflection, as small errors in observation give a greater percentage error for small deflections than for large. They should be calibrated at regular intervals, and if at any time it is suspected that they have been subjected to abnormal usage, their calibration should be checked at once. Care should be taken that they are not used beyond their capacities, as in this way the calibration may be changed, or they may be damaged.

It is best to avoid the use of instrument transformers wherever possible, but when it is necessary to use them, they should be calibrated at the proper frequency, with loads equivalent to the instruments with which they are to be used.

Instruments should be located so as not to be influenced by stray fields. Neglect of this precaution may, in many cases, result in the introduction of serious errors. Careful note should be made of the way in which the instrument is connected in the circuit so that, when necessary, correction can be made for the losses that occur within the instrument itself.

Tests

Complete tests on transformers ordinarily include:
Ratio,
Polarity,
Resistance,
Iron loss and magnetizing current,
Copper loss and impedance,
Heat run,
Over-potential test,
Insulation test.

Each of the above tests will be considered separately.

Ratio

There is little difficulty in measuring the ratio of large power transformers. The number of turns is comparatively small and almost any convenient voltage may be used. Great care, however, must be used in order to get the correct ratio of small high-voltage transformers, and particularly those to be used with instruments. With the latter it is necessary that the ratio be correct within very narrow limits or the accuracy of the instrument readings will be seriously affected.

In measuring the ratio of small transformers with voltmeters in the ordinary way, it is necessary to apply practically normal voltage in order to secure accurate results. If only a small percentage of normal voltage be used, the drop due to the load of the measuring instrument alone will introduce considerable error. The most satisfactory way of measuring the ratio of such transformers is by paralleling them with standards of known ratio that have been specially designed with a large number of taps covering a wide range with very small steps. With a testing set of this kind, the ratio can be determined with a close degree of accuracy.

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*By W. M. McConahey and C. Fortescue before the I. E. E.

Polarity

The polarity of single-phase transformers is easily measured and requires no special precautions.

The polarity of three-phase transformers involves the relations between the phase displacement and the direction of the voltages at the terminals of the high-tension and low-tension windings, and the necessary measurements should be made to determine these relations. This can be best done by connecting one of the high-tension to one of the low tension terminals and impressing a convenient three-phase voltage across either winding and measuring all the combinations of voltages among the six terminals. From these, and a knowledge of the connections of the windings (whether delta or star), a voltage phase diagram showing the polarity can be constructed easily.

Resistance

The utmost care should be used in measuring resistance in all cases where it is used as a basis for determining the temperature rise. In measuring the cold resistance, it is just as important to know the actual temperature of the winding at the time the measurement is made, so as to get a correct basis from which to calculate the temperature at the end of the heat run.

Where the transformer is standing in the air, several thermometers should be placed in close contact with the coils at several points and, before making the measurement, time enough should elapse so that the temperature of the coils will be within a degree or two of that of the surrounding air. In order to secure the best results, the measurements should be made when the air temperature is steady, or at least showing very little fluctuation.

Where the transformer is in oil, it should be allowed to stand until thermometers show a practical agreement between the temperature of the windings and that of the oil.

In making the measurements, the readings should be taken as quickly as is consistent with accuracy, and the current should be small enough to avoid any appreciable heating of the windings. The temperature of the windings as shown by the thermometers, should be carefully noted at the same time.

Resistances can be measured most satisfactorily with a Wheatstone or a Kelvin bridge, the former being used for the higher, and the latter for the lower resistance. The resistance to be measured is generally known approximately, so that the bridge can be set fairly close to the correct point beforehand, and the time taken in getting the correct setting, when measuring the resistance at the end of the heat run, can be made very short.

Iron Loss and Magnetizing Current

The iron loss is a function of the frequency, the voltage and the voltage wave form. The frequency and voltage can be determined easily, but this is not true of the wave form.

Since the iron loss may be appreciably decreased or increased, according to whether the voltage wave form is peaked or flattened it is very desirable to have some satisfactory method of getting the proper correction to be applied to the wattmeter reading, so that the corrected result will be the same as would have been secured if the voltage wave had been of the sine form. It is possible to arrive at this by taking an oscillograph curve of the voltage wave when the iron loss is being measured, and analyzing and comparing it with the true sine form. This is a tedious operation, and one not suitable for commercial testing. A very satisfactory way of making the correction easily and directly is by using the iron loss voltmeter. This instrument gives at once the necessary correction without any calculation, and is therefore exceedingly useful for making iron loss measurements.

If the generator used in measuring the iron loss is large enough so that it is only lightly loaded, and if its voltage wave closely approximates the sine form, there will be very little wave distortion, and the correction to the wattmeter reading will be negligible. In order to make sure of this, however, it is best to use the iron loss voltmeter in all cases.

In a transformer having a large magnetizing current, the I^2R loss in the winding during the iron loss measurement may be appreciable. This loss is constant at all loads, and may therefore be properly included in the iron loss.

Due to the voltage drop in the primary winding, the induction in the iron will be slightly decreased in going from no load to full load, thus tending to decrease the iron loss slightly. On the other hand, the path of the leakage flux about the windings lies partly within the iron, and this may tend to increase the iron loss under load. On the whole, the net difference is negligible, and the iron loss may be considered the same at full load as at no load.

Copper Loss and Impedance

In making copper loss and impedance measurements, care should be taken to see that the frequency is correct and that practically no increase takes place in the temperature of the windings during the measurement.

The frequency affects the eddy current loss in the copper, and also the reactance, which varies directly with it.

Since the copper loss varies with the temperature of the windings, correct results can only be secured by maintaining the temperature at a practically known value during the measurement. This is secured by placing thermometers in close contact with the windings and letting them remain there until they show a steady temperature, and then taking the readings as quickly as possible.

Knowing the temperature of the windings at the time the readings are taken, the copper loss for any other temperature can be calculated with very little error, except where the eddy current loss is very large. In the latter case, it is best to take the copper loss at or near the temperature desired.

Distorted wave form of e.m.f. has very little effect upon copper loss or impedance, unless the distortion is very bad.

Heat Run

The heat run is made chiefly to ascertain the temperature rise under given load conditions.

In getting the temperature rise by resistance, great care must be taken in making the measurements, cold and hot, as discussed under "Resistance." Care must also be used in getting the temperature of the cooling medium or water.

For oil-insulated water-cooled transformers, the surrounding air has some effect upon the cooling, but it may be neglected. The temperature of the ingoing water is taken as the basis for calculating the temperature rise. The source of the water supply is generally such that its temperature remains practically constant during the heat run, so that the principal points to be observed are to see that a thermometer is placed in the ingoing water; that its readings are carefully recorded at regular intervals; that the flow of water is kept constant, and that practically an equal amount of water flows through all parallel coils. At the end of the heat run, the flow of water and the power should be shut off at as nearly the same instant as possible.

For air-blast transformers, the temperature of the air in the pit is the basis for calculating the temperature rise, and it should be maintained at a practically steady value during the heat run and particularly near the end. The dampers should be adjusted to give the proper flow of air, which is generally such as will show a temperature rise of 11 or 12 deg. in passing through the transformer. In shutting down at the end of the heat run, the air blast and the power should be shut off at the same instant.

In making a heat run on an oil insulated self-cooling transformer, its temperature is determined by that of the surrounding air in the room. The room temperature is always a more or less variable quantity and hard to control, and should therefore be given careful attention. The room should be well ventilated, but strong air currents should be avoided. A steadily rising or steadily falling air temperature towards the end of the heat run introduces an error into the determination of the temperature rise that is not easy to eliminate. A satisfactory way to correct for the error is to have an unloaded transformer standing nearby and using the variation in the resistance of its windings as a basis for the correction.

Oil-insulated self-cooling transformers, when on heat run, should be separated by a space approximately equal to the width of the tanks. Thermometers should be placed about the transformers at a height that can be read conveniently, and far enough away not to be influenced by the radiation of the heat. This will generally require a distance of six feet (1.8 m.) or more from the transformers.

It has been the rule heretofore, to make a correction of one-fourth of one per cent. in the temperature rise, as calculated from the resistance, for each degree of variation of air temperature from the standard of 25 deg. Experience, however, seems to show pretty conclusively that this is in error and that, for all practical purposes, no correction should be made.

Insulation Test

Before making this test, all the terminals of the high-tension winding, and also all those of the low-tension winding, should be connected together. Also, while testing between the high-tension and low-tension or ground, the low tension should be connected to ground. Otherwise, in testing between the high-tension and ground, dangerous stresses may be set up between the low-tension and ground far in excess of any that may occur in service, and a breakdown may result.

In making tests of about 50,000 volts or more, a spark gap should always be used. Because of the voltage rises that takes the ratio of primary to secondary voltage of the testing transformer cannot be taken as equal to the ratio of turns, so that, without the spark gap, there is no measure to the actual testing voltage. A high resistance, sufficient to limit the flow of current to a small amount, should be placed in series with the gap.

Air bubbles in the oil about the transformer may be a source of serious trouble, and therefore, if there is any indication of their rising to the surface of the oil, the insulation test should not be applied until they cease. The test should be made immediately following the heat run, while the transformer is warm.

Over-Potential Test

This should be the last test applied. With high voltage transformers, in particular, care should be taken to see that all terminals, connectors, etc., are in proper place. The frequency used should not be higher than is necessary to keep the magnetizing current within reasonable limits.

It is necessary in this test, also, that there be no indication of air bubbles in the oil.

Vancouver Island Telephones

To get thoroughly in touch with conditions on Vancouver Island, officials of the B. C. Telephone Company spent a week recently in making a tour of the Island, visiting all the points where the company operates. Development has been considerable in and around Victoria, in the territory between Victoria and Nanaimo, at Alberni on the west coast, and north in the vicinity of Courtenay. As a result of the extended trip, improvements are planned at nearly all the places visited.

In the party were Messrs. George H. Halse, secretary-treasurer; F. J. MacGougan, commercial superintendent; George McCartney, superintendent of construction, and E. P. Labelle, plant engineer.

At Gordon Head, four miles out of Victoria, a new exchange is to be installed, and also at Cobble Hill, about midway between Victoria and Nanaimo, on the line of the E. & N. Railway. Service is also to be given Mount Tolmie, and an extension of the Victoria city system is to be made for this purpose. Duncan is also to have extensions made to the outside plant, and considerable work will be done at Nanaimo. Parkerville, north of Nanaimo, is progressing, and a new switchboard is now being manufactured in the company's warehouse at Vancouver, to be installed there. Additions are to be made to the system at Port Alberni. Conditions were found fairly good at Union Bay, Cumberland, Courtenay and Comox, and at Grantham, an agricultural district north of Courtenay, a demand for telephone service has been made.

While on the Island, the party of officials covered the whole of the route of the new toll line between Nanaimo and Victoria, which will be the land end of the new line between Victoria and Vancouver, in connection with the cable to be laid across the Gulf of Georgia in June. Three gangs are working on the land line on the Island, one out of Victoria, and the other at Nanaimo working south. This line will be ready when the cable arrives.

The poles are on the ground for the span across Nanaimo harbor. These will be 150 feet in height, and are in one piece, and will hold the aerial span between Nanaimo and Newcastle Island. There will be a stretch of a mile across this island to where the cable will land.

Personal

Mr. W. J. Baskerville will fill the late Mr. Brophy's place on the board of directors of the Ottawa Electric Company.

Mr. Lawford Grant was recently elected a director of the Insurance & Brokerage firm of E. M. Sellon & Company, Limited, Montreal.

Mr. Charles F. Gray, consulting electrical engineer, Winnipeg, announces that owing to increasing business, he has moved to larger quarters in the Union Trunst Building, of that city.

Mr. E. A. Graham who was recently appointed electrical engineer of the Winnipeg Electric Railway Company has resigned that position, being forced to go south on personal business matters.

Mr. Gerald H. Moore has been appointed resident engineer of the Canadian British Engineering Company, Limited. Mr. Moore is a son of the late Col. Moore, formerly chief of mounted police in the Winnipeg district.

Mr. Thomas Ahearn, president of the Ottawa Electric Railway Company and Mr. James D. Fraser, secretary-treasurer of the company have returned from a three weeks trip to Havana, and the Panama Canal zone.

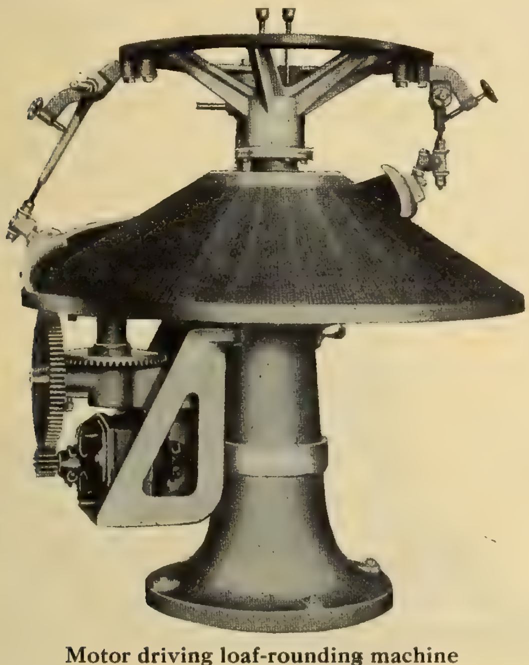
Mr. Redmond Quain has been appointed on the board of directors of the Ottawa Electric Railway Company to succeed the late Mr. George P. Brophy. Mr. Quain, who is 52 years of age was one of the pioneers of the street railway in Ottawa and was on the board of directors during the first few years of the company's existence. He has acted as auditor of the company for several years.

The Diverse Uses of the Electric Motor

It is applicable to every phase of every industry and trade—It means simplicity, efficiency, economy and continuity of service—It is the basis and symbol of Twentieth Century Advancement

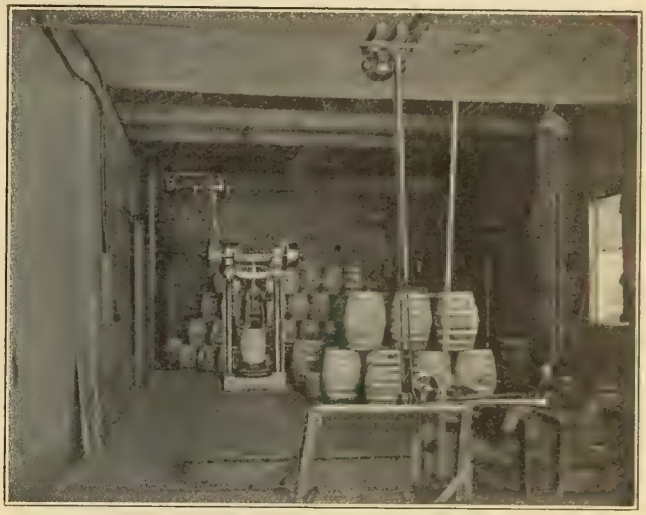
It is generally recognized that the electric motor is supplementing every other kind of drive in every kind of manufacturing industry and in the utilization of these manufactured products, but it is possibly not recognized to how great an extent the advantages possessed by motor drive off-set any disadvantages of inconvenience to change or expense incident thereto. A study of this subject, the applicability of electric drive, indicates that it is a practical impossibility to suggest any kind of moving machinery to which motors of one size or another or one type or another are not applicable. It is with this idea in mind that the present article, which is an attempt to classify in a general way the uses of electrical motors throughout the whole field of their applicability, has been prepared. It is not claimed however, that mention will be made of every instance of applicability as a complete discussion of the situation would require more space than is available in a publication of this kind. That this latter statement is true only emphasizes once more the universality of the electric motor in 20th century industrial, commercial and domestic life.

In the following pages motor applications are not considered in any sense in the order of their relative importance or size. The article is primarily intended to point out the wide applicability of the small motor. To render the article more valuable as a reference the industries or applications have been arranged in alphabetic order though the reproductions referring thereto are not necessarily in the same order.


Motor driving loaf-rounding machine

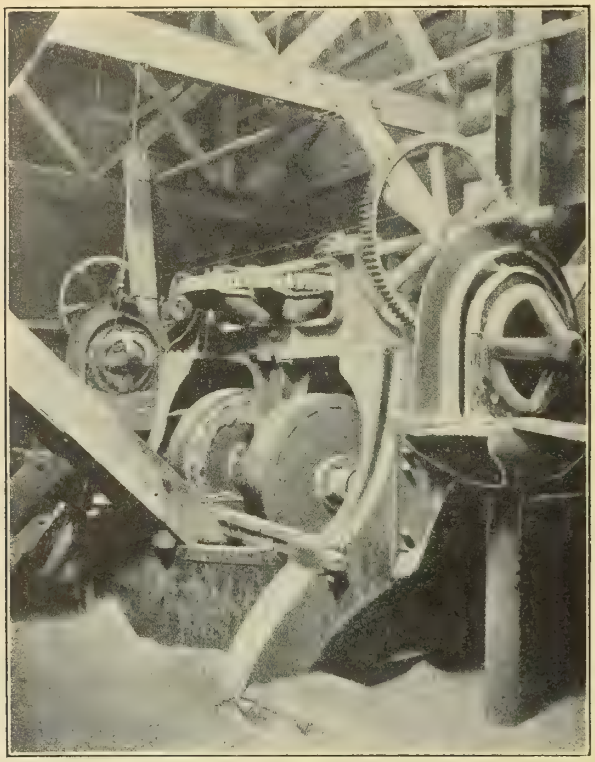
The superior applicability of the electric motor to every form of drive in practically every form of industry having been recognized therefore, it remains largely to satisfy the manufacturer that convenience, operating costs, increased factor of safety, increased quantity of work, improved quality, etc., are also factors associated with electric drive. Possibly the one factor in this list which it is most difficult to defend is that of cost but even here the efficiency of the modern motor and the advantageous power rate the manufacturer is able to demand in the majority of cases makes for an operating cost which other forms of energy can very rarely compete with.

Of course in the matter of current costs there are two sides to the question. The manufacturer is anxious to use his motor equipment as short a time each day as possible and to install the smallest capacity possible. On the other hand the central station is anxious to see the greatest possible amount of energy and where he finds that a certain class of customer does not use more than from 5 to 10 per cent. of his installed capacity on the average, it is reasonable to expect that he will not be particularly anxious to push this class of business. And right here we may have the reason why motor equipment which appears to possess so many advantages has not been installed by a number of manufacturers who would evidently gain financially and otherwise by their use. It is simply because the central station has not felt it to be particularly to his own interest to enlarge this class of customer.


Motors driving hooping and pitching machines

Often also it has been difficult to give anything like a fair estimate to a prospective customer of what his power is going to cost. Figures covering data of this sort have not been available and so it has not been possible to assure any class of manufacturer that the power he would require in his business would only be 10 per cent. or 15 per cent., or as the case may be, of his total manufacturing costs. In this connection it is of interest to note that under recent date the National Electric Light Association compiled a list of the load factors of a number of industries, which we print herewith. It is not intended that these figures should be taken to represent universal conditions as these would vary quite widely between two points, but it will at least blaze the way towards obtaining more accurate results in the future. Use may be made of this table in the following way:—Suppose the load factor of any particular industry is 15 per cent. It is easily possible to obtain from any of the manufacturers who supply motors for this particular industry just what capacity of motor would be required to cover all the machines in use. Suppose in this case it is 400 kw.

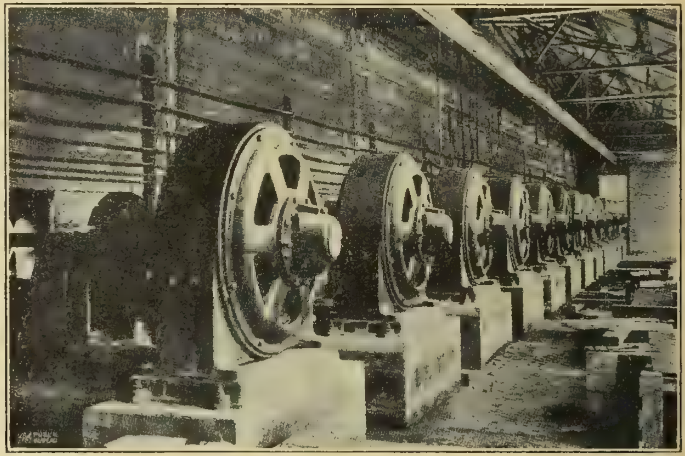
At 15 per cent. load factor this means a continuous 60 kw. load for (say) eight hours a day or a total of 480 kw. hours. At (say) 2c per kw. hour, energy will cost $9.60 per day, or per year of 310 days slightly less than $3,000. If now the total manufacturing costs are known to any manufacturer he can obtain the percentage cost which his power represents of the total cost of manufacturing his product. As being of interest in the working out of results of this kind the table of average load factors as mentioned above is reproduced herewith.



Brick making—C.G.E. motor driving 5 dry pans

Average Load Factors for Different Classes of Service

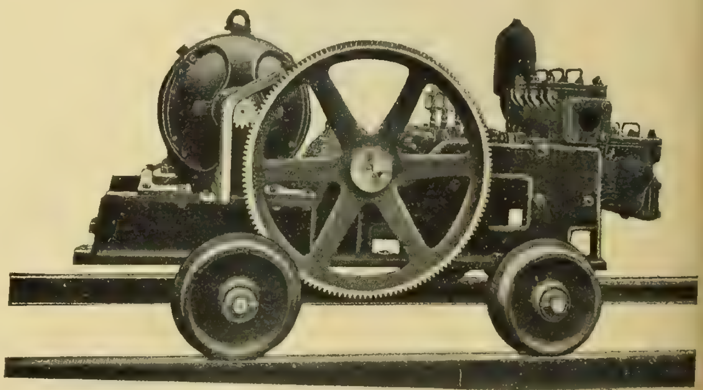
Bakeries, 12; bed manufacturing (brass and iron), 20; belt manufacturing, 10; blacksmith shop, 15; boiler shop, group, 18; boiler shop, individual, 8; bookbinders, 9; boots and shoes, group, 25; boots and shoes, individual, 17; brass finishing, 25; breweries, 45; broom manufacturing, 15; brush manufacturing, 7; bottling works, 10; butchers, group, 15; individual, 9; can manufacturing, 30; candy manufacturing, group, 18; candy manufacturing, individual, 9; carpet cleaning, 15; carpet weaving, 17.5; cement mixing, 10; chemical works, 11; cigar boxes, 6; clothing manufacturing, 18; coffee roasting, and grinding, 7; coopers, 5.5; creameries, 20; diamond cutting and polishing, 13.5; dye works, 15; electroplating, 20; electrotypers, 20; feather cleaners, 12; feed grinders, 6; fertilizer manufacturing, 75; flour mills, 23; forge shops, 10; foundries, brass, 6; foundries, group, 15; foundries, individual, 9; glass grinding and polishing, 17; glove manufacturing, 25; glue manufacturing, 15; grain elevators, 10; grocers, wholesale, 15; harness shops, 10; hoisting and conveying, 10; ice cream manufacturing, 20; ice making, 30; ink making, 23; jewelry, 15; knitting mills, 25; laundries, 20; leather, 8.5; lithographing, 10; machine shops, group, 20; machine shops, individual, 8; marble workers, group, 18; marble workers, individual, 10; mattress manufacturing, 6; newspapers, group, 18; newspapers, individual, 8; ornamental iron works, 17; paint manufacturing, 25; paper box manufacturing, 18; pipe threading and cutting, 8; plumbing, 20; pottery manufacturing, 13; printing (job), group, 18; printing (job), individual, 7; printing (magazine), 20; packers, 25; refrigeration, 50; restaurants, 20; rock crushing, 18.5; rubber manufacturing, 9.5; saw manufacturing, 30; screw manufacturing, 30; seed cleaners, 18; sheet metal workers, group, 15; sheet metal workers, individual, 10; silversmiths, 7; spice grinding, group, 12; spice grinding, individual, 8; soap manufacturing, 20; stone working, 6; structural steel manufacturing, group, 20; structural steel manufacturing, individual, 12; tannery, 20; telephone stations, 25; textile mills, 25; tinsmiths, 10; tobacco, 14; twine mills, 30; woodworking (general), group, 18; woodworking (general), individual, 6; woodworking, furniture, 28; woodworking, box making, 10; wall paper manufacturing, 12; wagon builders, 5; wheelwright, 9.



Row of 12 C.G.E. motors in Cement mill

Electric Equipment in Bakeries

The progressive modern baker requires a model plant in which cleanliness, efficiency and economy are combined to the highest degree. Such a plant must have electricity because the simplicity, convenience, economy and cleanliness of the electric system of driving and lighting are unequalled. As in other manufacturing industries the use of electricity means economy of space, economical location of machinery, better lighting arrangements, greater safety to operators, lower fire hazard, less time lost in starting and stopping machinery and lower operating costs because the machines cost nothing when not in use. Among the applications of electricity are dough mixers requiring only a small motor of a few h.p., dough dividers requiring also only a small motor, dough handling outfit, cake machine requiring



C.G.E. motor driving portable mine pump

approximately one h.p., loaf rounder requiring only a small motor, loaf moulder, stacking machine, etc. Even if the machines were not originally designed for electric drive, it may later be installed either through belt or gears at very little expense and without any increase in space.

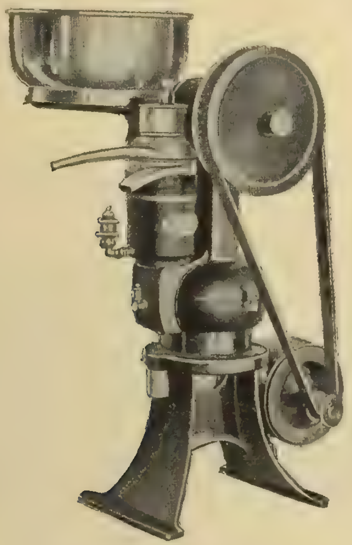
Bakers using electric motors report very little, if any expense for repairs. The cost of power is scarcely that of doing the same work by hand. Only the power actually used is paid for and a large number of bakers operating machinery in shops turning out from 500 to 1,000 loaves of bread per day have found that the adoption of a motor driven dough mixer has effected a saving of from $10 to $12 per week for this item alone.

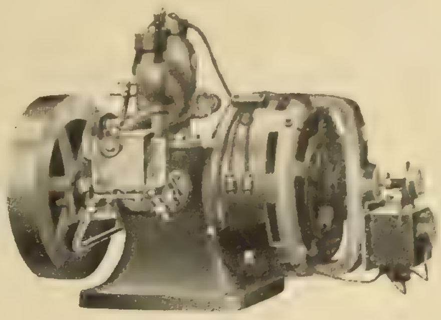
C.G.E. motors delivering concrete at Gatun Locks

The interesting process of bread making in a typical electrically driven bake shop is as follows:

"The flour is unsacked into a bin in the cellar and elevated by a flour lifter and conveyor in the large hopper above the dough mixer, the hopper being suspended from a lever connected with the scale beam so that it can be weighed at any time.

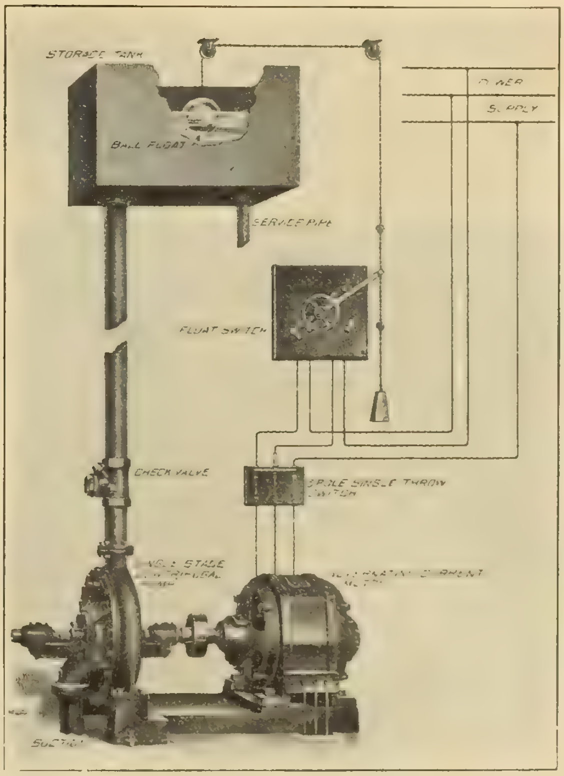
A dough mixer, dough brake, and a flour sifter and conveyor are grouped on one 5 h.p., 1,200 r.p.m. motor. The dough divider is usually driven by a 2 h.p., 1,200 r.p.m. motor. The dough is transferred to this machine from the rising tubs and, with each revolution of the wheel, four loaves of any desired weight are punched out and dropped upon the delivery belt. The weight of the loaves may be regulated at will by a simple adjustment of the machine. This machine has an ingenious arrangement of small hoppers which sift flour in the dough at the proper intervals to avoid any tendency of the dough to stick. The belt, upon which the loaves drop, consumes one minute in making one-half a revolution, i.e., one minute after a loaf drops upon the belt it is delivered to the moulding machine at the other end of the table, thus allowing the loaves to recover from their compression.


C.G.E. motor driven separator


C.G.E. 1 kw. gas-electric generator

The loaf moulder is driven by a 2 h.p., 1,800 r.p.m motor which is also geared so as to drive the delivery belt. This moulding machine kneads the loaves exactly as the old-fashioned baker did, turning them twice from end to end, then twice from the side and finally rolling them around the big wheel at the bottom, where they come up and roll into the pan on the shelf from whence they are carried to the oven. This machine is also equipped with a flour sifter to keep the dough from sticking."

The estimated consumption of current for a modern bakery of a capacity of 40,000 loaves daily in addition to several hundred pounds of pies and cakes is approximately 1000 kilowatt-hours a month.

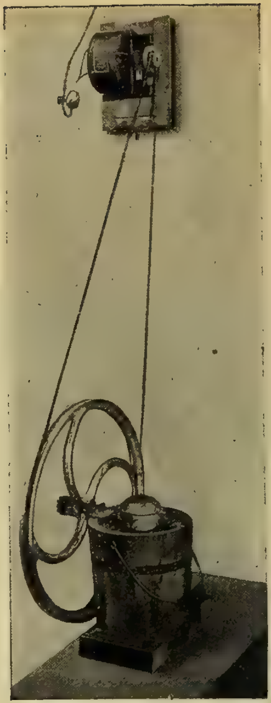


C.G.E. motor operating farm water system

Brewing Industry

The manufacturers of beer and malt are now employing electric drive quite extensively as a means of decreasing the cost of production and at the same time improving the

C.G.E. motor operating corn-cutter and silo filler

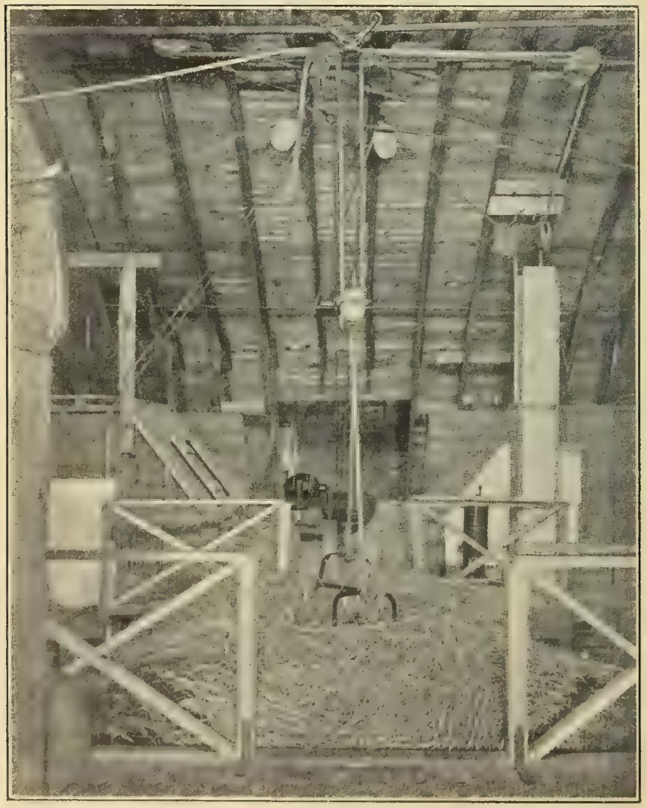


Freezer, motor driven

quality of the product. The application of electric motors to the various machines has enabled the manufacturer to obtain more sanitary conditions and better location of machinery for the successive operations. In almost every installation the individual system of drive has been adopted even for the small power machinery required in the bottling department, thereby insuring maximum flexibility with minimum power requirements.

Among the uses to which motors can be put in this industry is the operation of refrigerating machinery, pumps, elevators and conveyors, mash tub, keg and barrel washer, bottle filler, crowning machine, barrel hooping and pitching machines, chip washer, pasteurizing and labelling machines, bottle washer, malt cleaner and grinder, etc. A typical installation is represented in the following table:

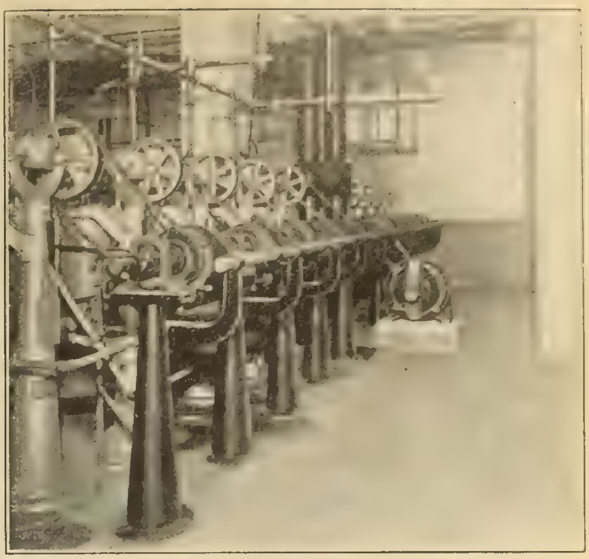
Machine	H.P. of Motor	Group or Individual	No. of Motors
Washing machine	7½	Indiv.	1
Tank room agitators	5	Group	2
8 by 8 air compressor	15	Indiv.	1
Machine shop	5	Group	1
Centrifugal pump	15	Indiv.	1
Mash tub	15	Indiv.	1
Mash conveyor	2	Indiv.	1
Mash pumps	2	Indiv.	1
Malt cleaning and rolling	7½	Indiv.	2
Blower for grinder	1½	Indiv.	1
Beer pumps (4)	5	2 groups	2
Barrel shop	2	Indiv.	1
Bottling works	7½	Group	1
Mangle	2	Indiv.	1



C.G.E. motor operating hay and straw fork

Battery driven motor farm truck

C G.E. mtoor driving grain separator



Ice cream manufacture by motor

Triplex pump	20	Indiv.	1
Centrifugal pump	10	Indiv.	1
Carpenter shop	15	Group	1
Forge fan	2	Indiv.	1
Elevator (2 ton cap.)	15	Indiv.	1
Mash dryer	10	Indiv.	1
Grain elevator	5	Indiv.	1
Centrifugal pump	5	Indiv.	1
Centrifugal pump	15	Indiv.	1
Ice hoist	5	Indiv.	1

Brick Plant

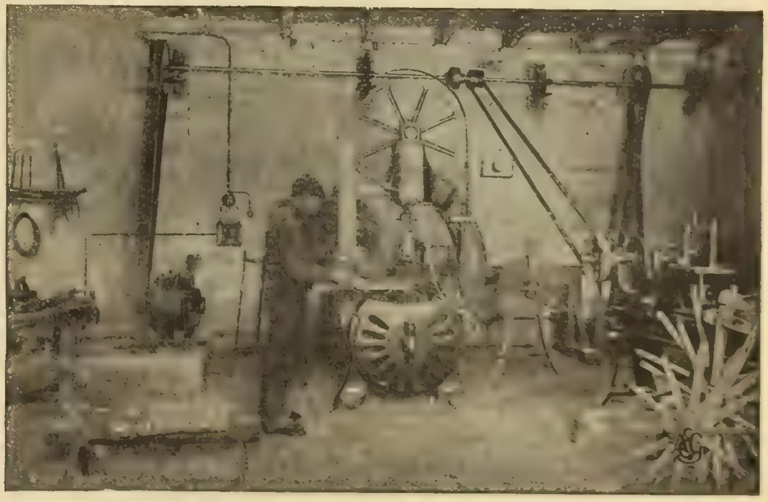
Though the art of brick making is among the oldest of established industries, it is only within the past twenty years that the introduction of power-driven clay working machinery has revolutionized the art and given it its proper rank among the world's industries. It is probable there are now more than 100 varieties of brick manufactured and that the total output on this continent is in the neighborhood of 3,000,000,000 per year. This result has been obtained only through the aid of the electric motor.

With motor drive any individual machine or group of machines can be operated independently of the rest. Often in brick plants the points of application of power are widely separated necessitating make-shift methods or the installation of wasteful and inefficient non-condensing steam engines. Excavating shovels and drainage pumps at the clay pits, ventilating fans in the dry house and the brick machines proper invariably require separate sources of power unless a centralized system of electrical distribution is employed. With electric drive additional motor driven units can be installed from time to time and the capacity of the plant increased without reference to existing line shafts and belting problems. Electric drive is without question the cleanest, cheapest, safest, most flexible and most efficient method of distributing and applying power that has yet been devised, largely because the logical and economical sub-division of motive power in units of suitable capacity for any and all requirements is an advantage possessed by no other system of power distribution.

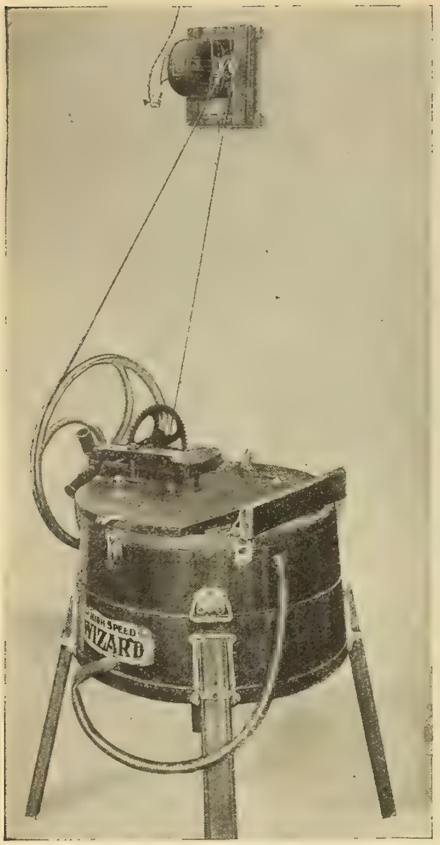
Among the uses to which small motors may be put in the brick manufacturing industry are the operation of dry pans, sanders, conveyors, fans, bucket elevators, pug mills, augers, tempering wheels, excavating shovels, hoists, granulators and pumps.

Accurate figures covering cost of electrical operation are difficult to obtain owing to the widely varying factors influencing production. Records from several plants with a daily capacity of from 50,000 to 100,000 soft-mud, sand mould-

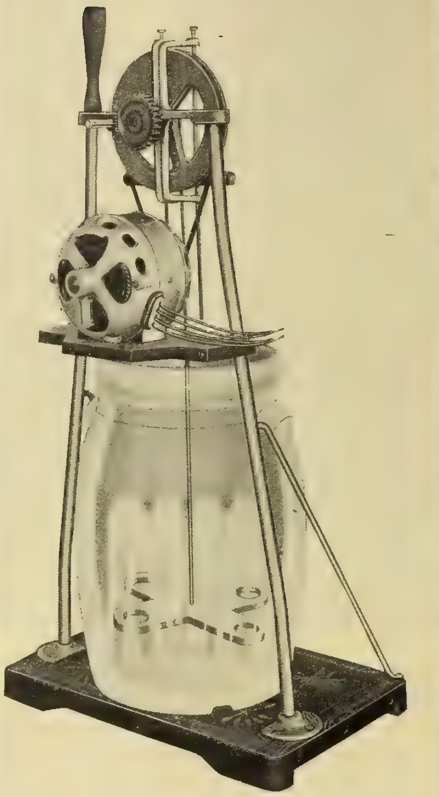
Kendrick & Davis utility motor



C.G.E. motor operating farm workshop

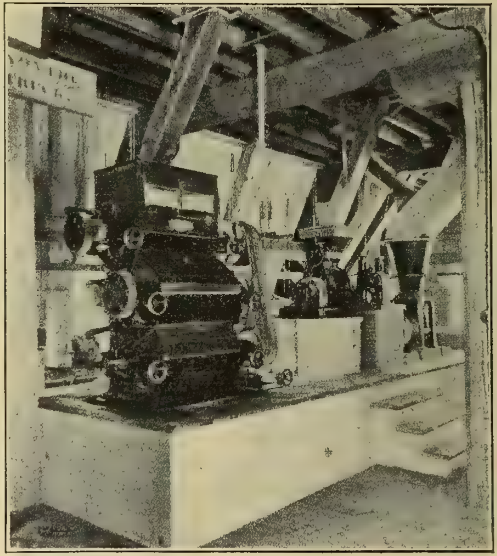


Can. West. motor operating washing machine



Century motor operating churn

C. W. utility motor in workshop



C.G.E. motor driven farm grist mill

ed bricks, indicate a fair average of 15 to 20 moulds of six bricks each per minute or from 90 to 100 bricks per kw. hour for all electrical power consumed. Plants using the stiff-plastic method show approximately the same output per kw. hour expended. One plant of 156,000 daily capacity shows a power consumption of 1740 kw. hours per day for its auger brick machines. Another plant with a daily capacity of 200,000 common bricks shows for two consecutive months an average monthly output of 4,700,500 bricks at an average expenditure of 45,600 kw. hours in driving its auger machines. Where the change from steam or other form of mechanical power has been made, a saving in operating expense of from 20 to 30 per cent. has often been effected. The total power required including auxiliary devices varies from 12 to 18 kw. hours, but a conservative estimate of power required by pug mills and augers is about 1.5 h.p. per thousand bricks per 10-hour day or 11 kw. hours per thousand bricks produced.

C.G.E. motor group drive on farm

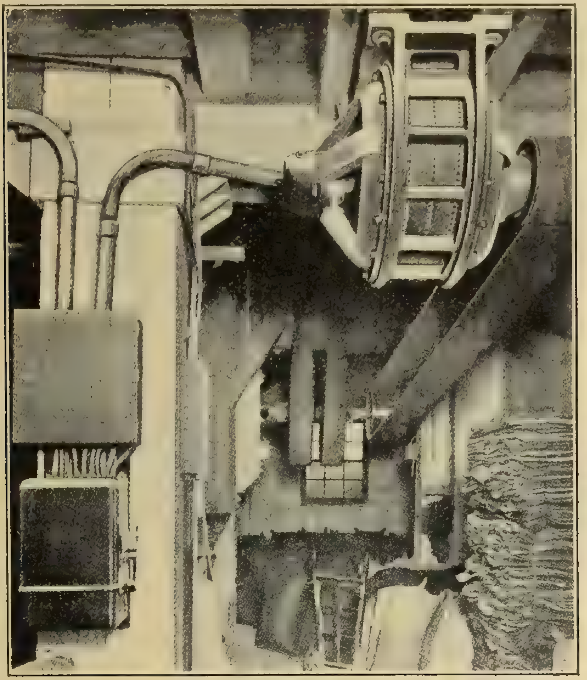
Cement Plants

There are certain inherent requirements in the manufacture of cement which establish the value of electric drive over all other classes of prime mover. Under normal conditions cement mills operate 24 hours a day for 7 days in the week and the mill must be kept in practically continuous production. Among the advantages of electric drive may be noted the following:—(1) With individual drive the shut down of any one machine need not affect the operation of any other machine. (2) The general lay out of the plant, to be most economical, must be determined solely by the relative locations of the quarries, the storage bins, the best location of the machinery and space available for extensions. This is best regulated through the use of electric motors. (3) A check can be more easily kept on the cost of manufacture. (4) Most cement machinery starts under a heavy overload and some are liable to short overloads during operation. This condition can be best cared for with electric drive. (5) Since the driving of cement machinery does not require any particular mechanical skill it is important that a form of drive of the same nature be adopted, hence rugged motors of a special type for this class of work are best suited to the conditions. One of the cuts reproduced herewith shows a number of motors, twelve in number, driving raw material tube mills in a large cement plant. These motors are coupled through flexible couplings to the counter shaftings of the mill, necessitating only one gear reduction. The concrete wall separating the motors from the mills secures an unusually clean motor room.

Electricity in Coal Mines

When it is considered that the yearly total production of coal on this continent approximates 600,000,000 tons, it is evident that the power requirements of the industry represent an expenditure of such proportions as to justify a most careful study of all factors entering into the cost of operation of the various types of machinery required in coal mines.

The use of electricity in coal mining has shown a rapid expansion during the last two or three years, due to a number of causes:—increased efficiency of electrical machinery; attention given by manufacturers to the needs of this particular industry; appreciation by mining engineers of the possibilities of electric drive; a marked success of the earlier installations; the operation of mines in localities not suited to other kinds of power operation.



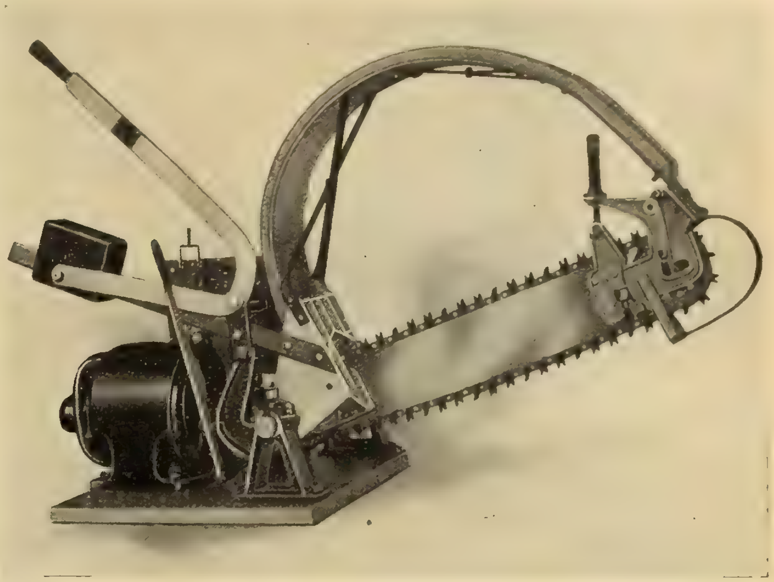
C.G.E. motor in flour mill

The Electrical News has, from time to time, pointed out the notable increase in the use of electric drive in mining operations and has endeavored to impress the value of this type of prime mover to an industry to which it seems to be peculiarly adaptable. The use of electricity eliminates the necessity for long lines of steam or air piping which are expensive to install and maintain. For these conditions electricity substitutes a simple and flexible system of power transmission by means of electric conductors which can be easily installed and extended to meet change requirements, which are not affected by temperature changes and are not liable to mechanical injury due to conditions peculiar to mines. The much smaller space required is also in many instances an important factor.

Perhaps in no phase of mining operations is electric drive more valuable than in the operation of mine locomotives. Electric drive for mine haulage possesses advantages of high efficiency, mechanical strength, dependability, simplicity of control and compactness, the latter characteristic being of extreme importance. Among the other uses to which electricity may be put may be mentioned:—the drive of friction hoists, stationary and portable pumps, water hoists, bucket conveyors, coal cutting machines, air compressors, coal extractors, etc.

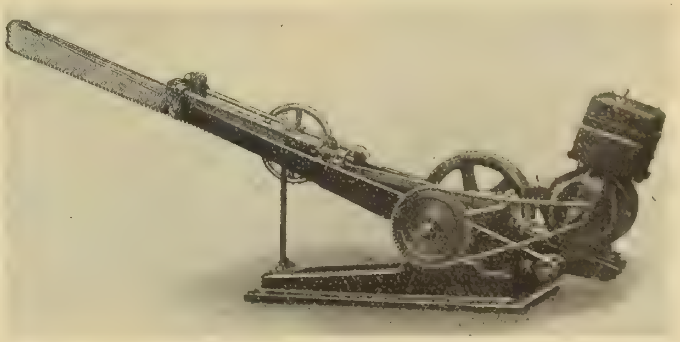
Excavation and Construction Work

The amount of construction work being carried on at the present day is limited only by the amount of capital available and the limitations of labor. It is therefore evident that the system of power application adopted will have an important bearing, not only on the cost of construction but on the amount of work that can be completed in a given time. In some plants much of this work has in the past depended on steam drive combined with compressed air service for auxiliaries, but during the past few years there has been a steadily increasing use of the electric motor until many of the largest engineering projects are to-day being carried through almost entirely by means of motor drive. This improvement in condition is the result of the greater familiarity of contractors in general with the characteristics of electric service and by the reliable results obtained by the use of the highly efficient modern electric motor. It is now possible to select motors specially suited to the particular load conditions imposed by any isolated piece of work. Added to the convenience of electric drive it has been shown that the actual cost of the different operations shows a considerable saving over steam use.



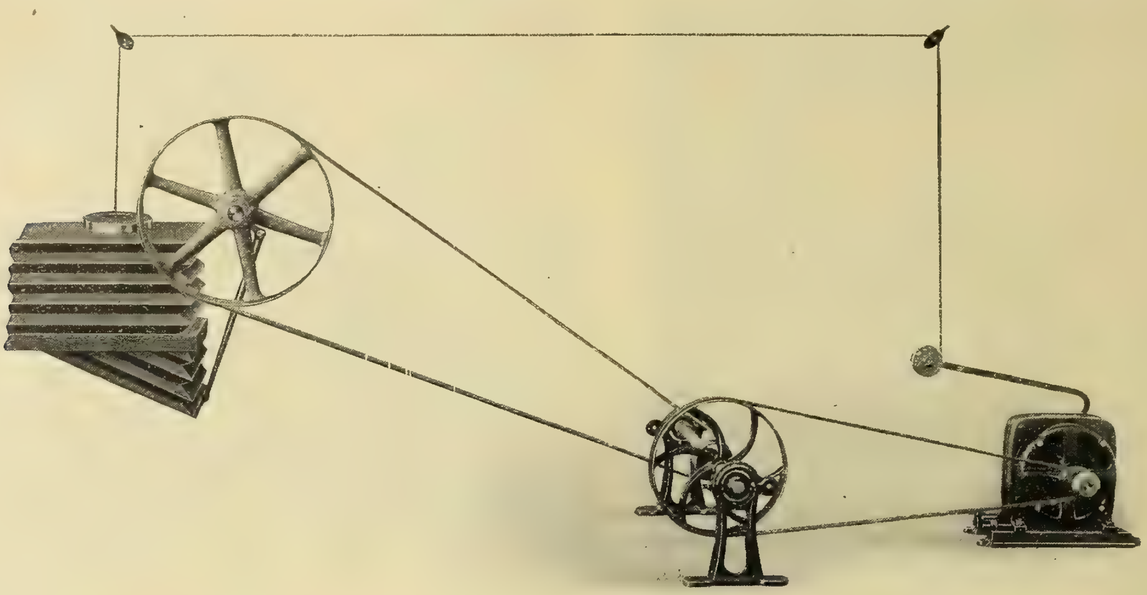
Endless chain saw for lumber camps

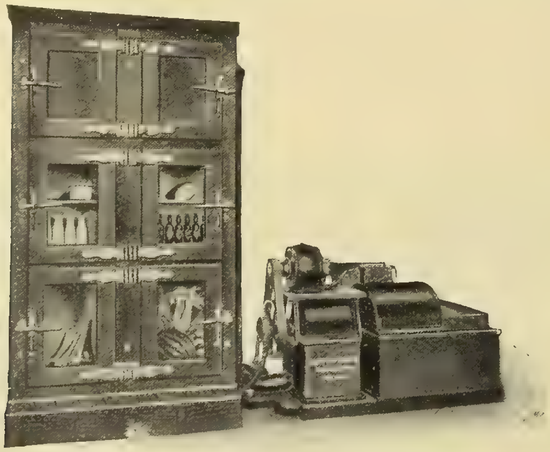
For practically all operations necessary in excavation and construction work the electric motor constitutes the most effective medium for the application of power especially when the machinery operated is located at a distance from the primary source of power. One of the most important characteristics of electric operation in excavation and construction work is the centralization of the power generating plant. By this centralization the cost of supervision and maintenance is greatly reduced. The use of electricity eliminates the necessity for the laying and maintaining of long lines of steam or air piping which are expensive to install and frequently difficult to keep in good condition.



Motor driving log-sawing equipment

In the application of electric motors to the various machines, the reliability and simplicity is such that their operation does not necessitate as expensive labor as is required when machinery is operated by steam engines. The number of uses to which motors may be put in this class of work is almost unlimited but a few may be mentioned such as operation of cable cars, excavating shovels, cranes, derricks, hoists, pumps, air compressors, locomotives for various sections of the work, dredges, bridge operation, elevators, crushers, mixers, etc. One of the cuts shown herewith represents the delivering of concrete to electrically operated cableways at Gatun Locks on the Panama Canal. Gatun Locks constitute the largest single piece of concrete construction in connection with this great work, calling for a total of more than 2,000,000 cubic yards. For supplying current for the material handling plants, two substantial power stations each equipped with three 1500 kv.a., 3-phase, 25-cycle, 2200 volt, turbo-generators were provided.

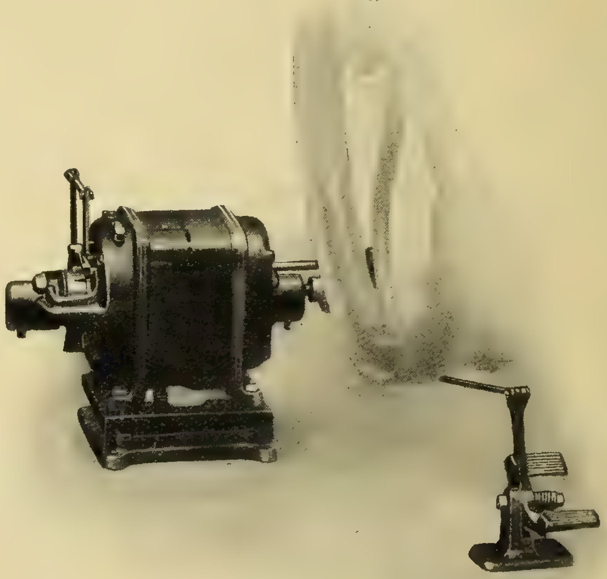

Kimble s. p. motor operating a pipe organ bellows

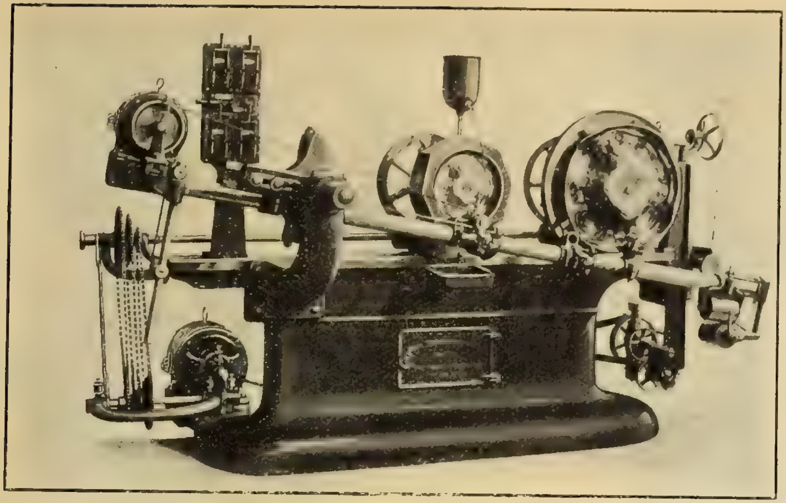

Motor driving J-M household refrigerator

Even in the smallest contracting work, as for example, in house building, the contractor finds it to his advantage nowadays to install a small motor to keep his tools in condition, operate a circular saw, etc.

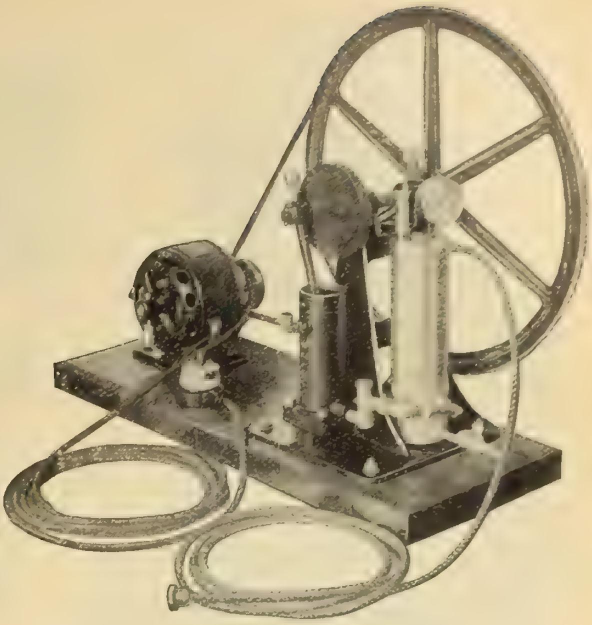
Farm Appliances

The next few years will undoubtedly see a marked development along electrical lines in this direction. In the past the application of electricity to various phases of farm life has been retarded by the isolation of the farmer. The erection of transmission lines covering rural districts has been more expensive on account of the relatively small load that could be expected to follow. Small isolated plants sufficient for the requirements of any individual farm were sometimes installed but these require considerable mechanical skill for their operation and besides represent a considerable initial cost. The tendency of the present decade, however, seems to point to the installation of transmission lines along practically every highway, at least in the immediate vicinity of central stations. The attitude of the farmer too is more favorable towards the utilization of electricity than was the case a few years ago. He has now come to recognize the difficulty of keeping his sons from going to the cities and the still greater difficulty of procuring labor when it is most needed. The use of electricity with its attractiveness will not only be the means of keeping the boys at home, but will also lighten and expedite the labor of the farm to such an extent that this work, which has formerly


Showing foot control of Kimble motor



C.W. motor operating engraving machine



Century motor operating air pump

been considered as one of the most unattractive forms of drudgery, promises in the near future to be looked forward to with pleasure and interest.

It is not likely that in the near future we shall see any general application of electricity to outdoor work, such as ploughing or the driving of farm machinery. The applicability will be through the operation of small motors in the home and around the farm buildings and of course in lighting these. Reports which are more or less conflicting have stated that satisfactory results have been obtained in stimulating the growth of grain or vegetables by the proximity of high tension currents but at this distance the process looks too expensive and uncertain. In the home however, the use of electricity is as applicable as in a city house and on account of the greater need even more so. For example, a water pumping outfit can be fitted up at small expense. Vacuum cleaners, meat choppers, coffee grinders, etc., are applicable. There is no reason why the mistress of the farm household should not have her electric vibrator, her electric hair-drier, her ice cream freezer, her electric fan, her electric polisher, washing machine, ironing machine, churn, sewing machine, and all the other little electrical appliances, just as well as her city sister. With the natural attractiveness of farm life it begins to look as if the movement in the very near future would be reversed and that difficulty will be experienced in keeping the rural sections from becoming overcrowded and the cities from becoming depleted.

Around the buildings too small motors are not only handy, but they are intensely practical. For example, in milking, in grinding grain or pulping vegetables or operating the fanning-mill. A little larger motor equipment may be used to advantage in unloading hay and grain, in threshing, in cutting and storing ensilage, chaff cutting, etc. Doubtless in the near future, storage battery operated motors will also be used extensively in traction work such as hauling in grain from the fields, distributing fertilizer, etc. The application of the small motor will also find an outlet in the operation of cleaning apparatus for the cattle and horses. We believe the average farmer will in the very near future find it to his interest to make a complete installation of the necessary motors for the applications mentioned above, and we believe that the expense both of installation and of operation will work out to be well repaid by the numerous advantages that will follow.

From time to time the Electrical News has described particular instances of the applications of electricity to farms. The most generally adopted method seems to be to give each individual farmer his own transformer. As a general thing this current has not been metered, the recognized moral attitude of the farmer being considered sufficient guarantee that he will keep within the amount for which he makes a contract. We believe central stations are finding this load a very satisfactory one, over-lapping in such a way as to give a quite good load factor. A number of applications of electricity to farm life are shown herewith.

Motor driven auto-horn

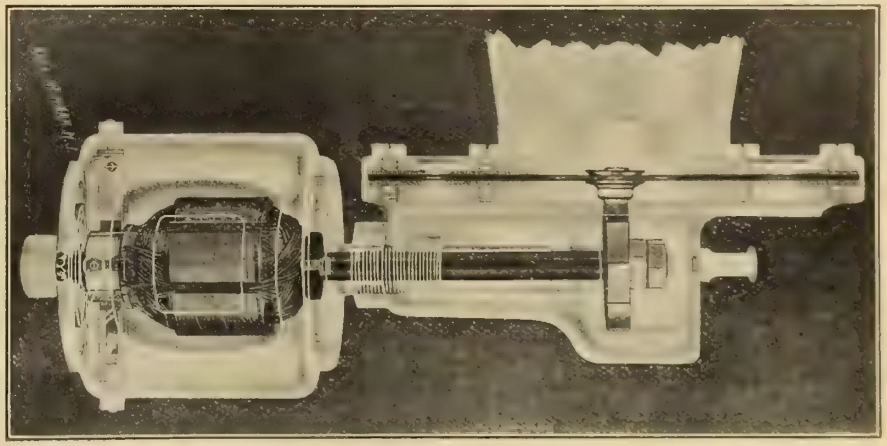
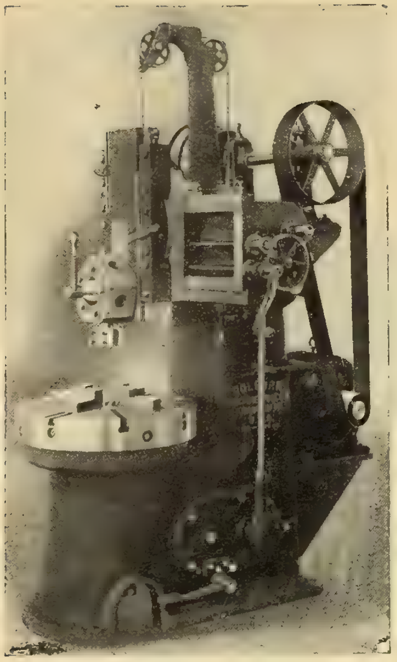
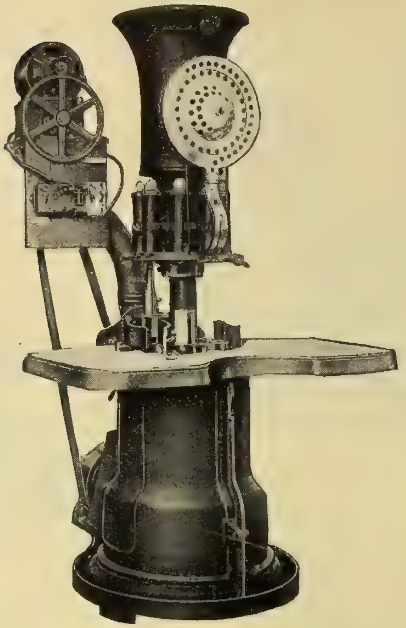


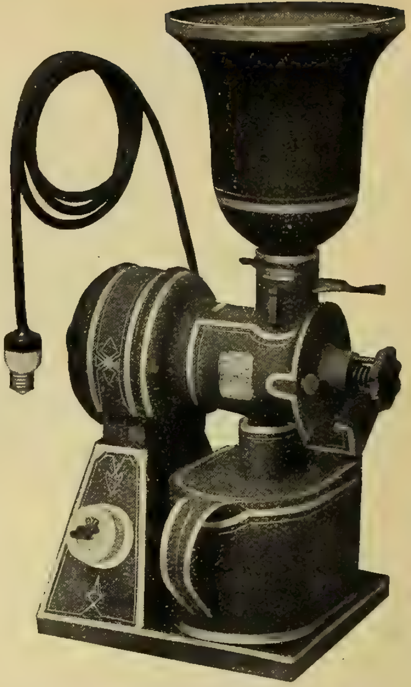
Diagram showing principle of motor driven auto-horn



Motor operating boring mill



C.W. motor operating bottle corker



Century motor driving coffee mill

Gold Dredges

The capacity of the steam driven dredge is largely limited by the scarcity of available fuel and the cost of obtaining it. It has now been recognized that the electric motor affords a compact, easily controlled and highly efficient substitute. Separate motors can be applied either directly or through short belting to the various units of the dredging machinery so that a larger percentage of the input energy can be applied directly in useful work. Among the uses made of motors on gold dredges are for operating buckets, winches, shakers, stackers, high pressure pumps, low pressure pumps, priming pumps, tool machines, etc.

Grain Elevators and Flour Mills

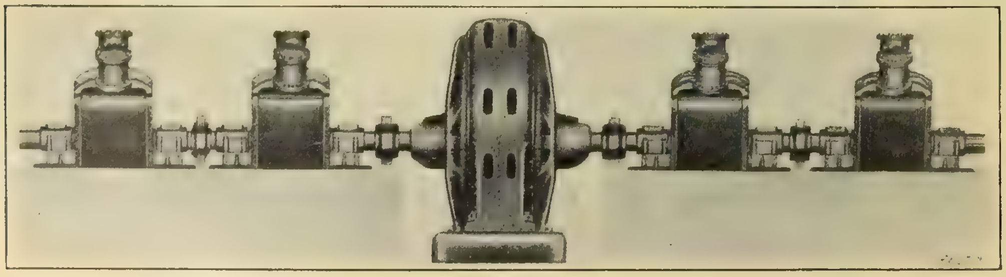
Among the considerations entering into the economic operation of the modern grain elevator and flour mill, perhaps the most important is the type of drive employed for the grain handling and milling machinery as this has a direct bearing on the quantity of product obtained for a given investment and determines largely the percentage of profit which may be obtained from the grain passing through the elevators and mills. In the past it has been the practice to drive the legs and conveyors by means of long lines of shafting or by rope or belt transmission operated by reciprocating steam engines or other prime movers but it has more recently been found that induction motors possess advantages for this work which render them superior to any other type of operative.

While in theory the best method of operating grain handling machinery is to use individual motor drive throughout, the practice in most of the grain elevators and mills which have adopted electric drive, has been to combine the individual and group systems. Ordinarily in grain elevators, individual motors are supplied for each elevator leg, car puller and exhaust fan while the cleaning machinery such as separators, screw conveyors, dust collectors, etc., are generally driven in groups by single motors. In flour mills the several milling processes are inter-dependent and it is therefore necessary that the different sections of the machinery should move as one unit. To accomplish this result with any drive the use of a large amount of shafting and belting is unavoidable with its consequent friction loss but under motor driving conditions the amount of loss is considerably less than under any other condition. Additional advantages are that the motors can be located close to the machinery so as to apply their power centrally on the main shaft also reducing the length of shafting and belting.

Among the further uses to which motors may be put in the modern milling industry is for driving the following:—dust fans, receiving elevators, shipping elevators, cleaner elevators, dryer elevators, car shovels, car pullers, belt conveyors, cleaning machines, passenger elevators, dust packers, dust agitators, etc.

Iron and Steel Industry

In no other industry is absolute continuity of process such an important consideration. The financial loss resulting from the temporary shut down of the main rolls is estimated at from $400 to $1,000 per hour, depending upon the nature



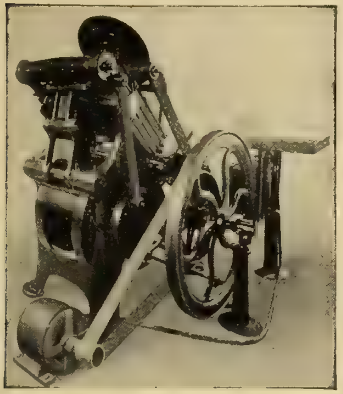
C.G.E. motor driving a number of pulp grinders on the same shaft

Masco massage vibrator

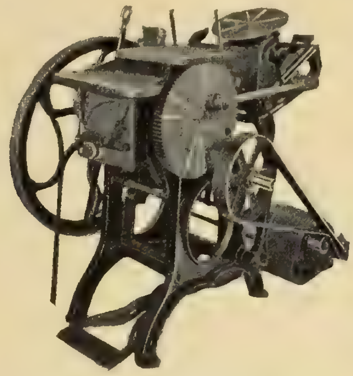
of the work involved. It is thus obvious that 24 hour service is of prime importance and that only the most efficient and dependable drive is permissible. For all steel mill work the electric motor has deserved this enviable reputation.

The practical and economic use of electricity in steel mills is of course by no means confined to power applications. The illumination of large areas consumes a considerable amount of energy and the electric furnace which has apparently passed the experimental stage will, when it establishes itself on a commercial basis require the installation of large additional generating units.

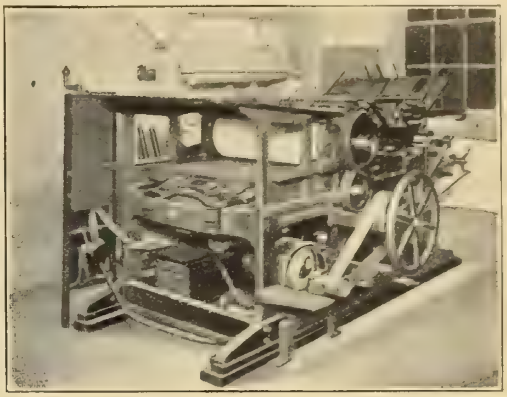
For the most part the motor equipments required in steel manufacturing are of comparatively large size including hoists, mixers, hoisting machines, plate mills, cranes, trucks, charging larrys, coke pushers, for operating furnace doors, hot saws, scale cars, plate shears, angle shears, bar mills, gas exhausters, blowers, hammer mills, coke extractors, unloaders, friction saws, gas washers, etc.



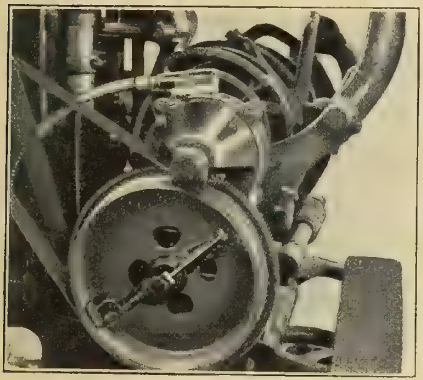
Small printing press, C.W. motor



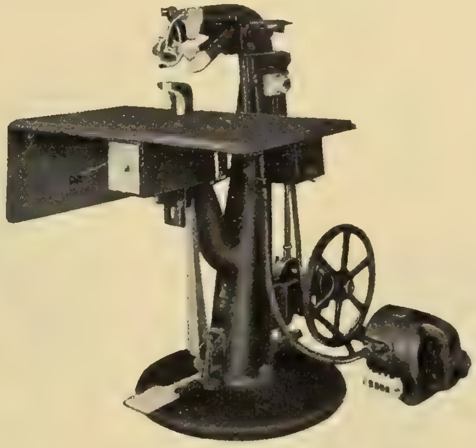
C.G.E. motor driving job press



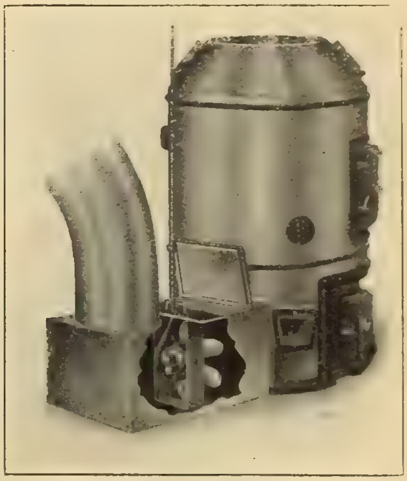
C.G.E. motor driving cylinder press



C.G.E. motor driving linotype machine



Pageing and numbering machine, $\frac{1}{8}$ h.p. C.G.E. motor

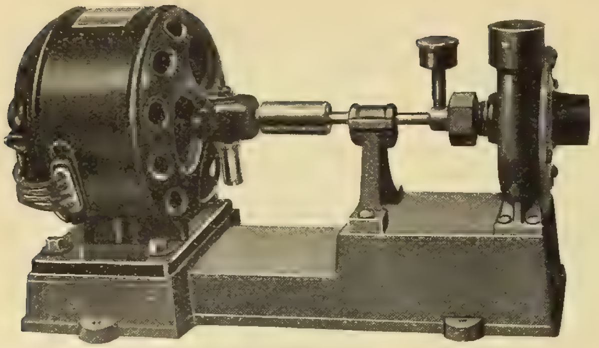


C.G.E motor operating draft fan

Lumber Industry

As in all manufacturing establishments the ideal attainment in the lumber mill is a maximum output with a minimum investment and a minimum up-keep expense. Electric power in so far as it contributes to this result is being given an ever increasing amount of attention and experience shows that under the severest service conditions electric drive has proven that it possesses advantages of efficiency and economy that are peculiarly associated with the conditions met with in the lumbering industry. It greatly reduces the waste of power in transmission. It improves the quality of the product. It increases the factor of safety to both machinery and workmen. It reduces the fire hazard. It practically eliminates overhead shafting and belts which interfere with proper lighting and ventilation, limit the location of machinery and thus prevent that natural sequence of location which is essential to avoid re-handling with its attendant expense, damage and congestion. An important feature is the ability to operate any group of machines or any individual machine at any time without utilizing the whole power equipment of the plant. The total amount of floor space required is greatly reduced and there is a marked improvement in the general appearance of the plant from the point of view of cleanliness, tidiness, safety and illumination.

In the lumbering industry fairly large sized motors are necessary. Up to the present time there has not been a very extended use of electricity in felling and sawing logs, but we understand developments along this line may be looked for in the near future. We illustrate herewith a couple of motor operated saws for lumbering purposes. The first refers to a product of the International Endless Chain Co., the second is manufactured by Jno. Pickles & Son, an English firm. Rather more progress has been made in logging by electricity especially where conditions are favorable. Motor equipments have also been used for unloading and loading purposes. The first equipment installed for this purpose was purchased barely three years ago, but the application has been pronounced a success. We understand also an electric motor equipment will soon be adapted to the log conveyor. Other uses which may be said to have become established are for driving circular saws of all sizes, blowers, band saws, for automatic filing and for elevated tramways to

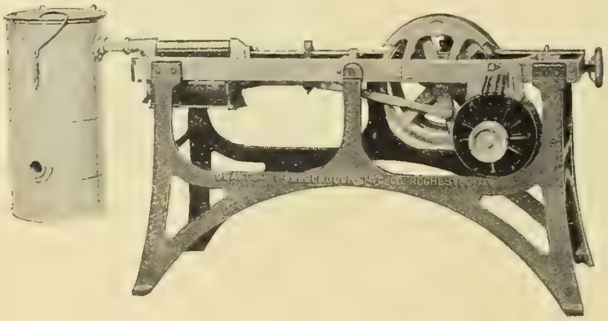


Century motor operating small pump

yards. Another use to which motors are applicable is in the hauling up of the logs into the mills. The size of these motors will vary of course with the size of the mill, but many of the applications mentioned would not require more than one or two h.p.

Metal Working Machinery

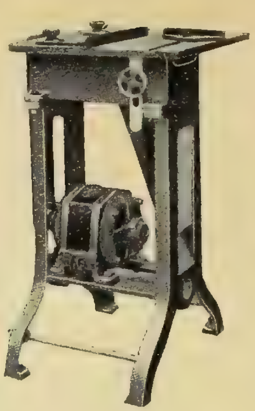
In the metal working industry as in woodworking, the large number of small machines operated for a comparatively short time at considerable intervals make the application of small motors particularly adaptable. Motor drive in the metal working industries has been successfully employed for a number of years and the resultant benefits are so widely appreciated that continued developments may be looked for. While increased production, and of a better quality, is obviously the most important result attained by the installation of electric drive, it is also true that direct economies are very frequently effected in the power costs. Apart from the saving in energy made possible by the ability of the operator to shut down those machines not engaged in productive work, the elimination of shafting, belts, pulleys, idlers, etc., which form an indispensable part of any mechanical system of drive, must, of necessity, result in important power economies, especially when it is remembered that mechanical drives often consume up to four times the energy required by the machines themselves. With individual motor drives the maximum power is made effective at the tool itself.



C.W. motor driving suction cleaner

Where individual motors are employed the most convenient and logical location of the machines may be secured, space easily provided for additional machines, use of overhead cranes facilitated, and other requisites to a properly conducted shop made possible.

Among the applications of electric motors in this industry may be mentioned the drill press, the portable drill of various types, cutting saws, cold saws, friction saws, shapers, slotters, lathes, milling machines, surface grinders, chucking machines, boring mills, planers, punch and shears, pipe machines, nipple machines, pumps, wheel presses, etc.



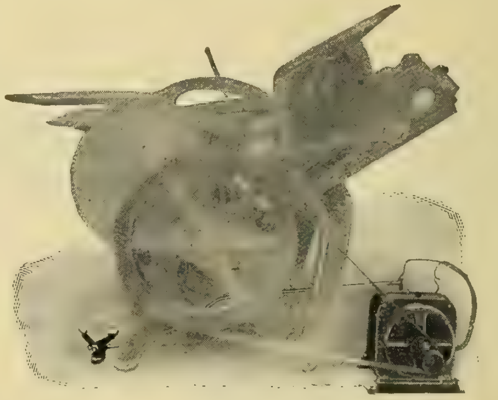
Motor driven metal saw

Masco motor on small pump

Printing and Allied Trades

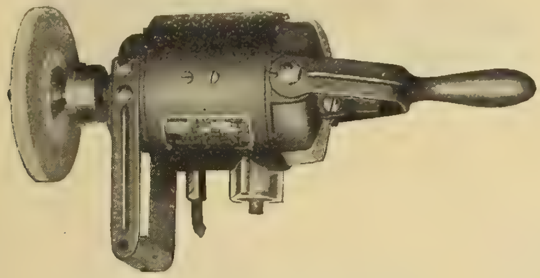
It is probably safe to say that no other industrial field requiring motive power has found electric drive more valuable than the printing and allied trades. They have been foremost too in appreciating the ability of motor drive to meet the exacting requirements of the industry. With electric power the printing establishments may be located in the most desirable business section where good light and easily accessible rooms are available. The day is past when printers, cramped in ill-lighted, dingy quarters remote from the line of travel, approached through dark hallways and by dangerous stairs, can carry on a thrifty business.

Owing to the great variety of work performed in these trades, the machinery as a rule requires a certain degree of speed variation in order that with a given equipment and force of operators the maximum of high grade production may be turned out. All necessary speed variations are most readily, economically and satisfactorily obtained with electric drive and control. Each press is at all times subject to instant adjustment so that the entire attention of the operator may be devoted to his work. In this connection we draw attention to a couple of the illustrations shown herewith in which the speed of the machinery is regulated by a foot lever. This particular motor is a single-phase reversible type and by its foot control leaves the operator with both hands free. It is claimed by the manufacturers that the operation of this lever becomes in a short time so much a matter of course that the operator regulates the speed of his machine involuntarily and without the slightest interruption to his regular work.



Kimble motor driving printing press

Motor driven presses closely approach ideal conditions for maximum production at minimum expenditure for a number of reasons; make-ready speeds may be instantly and correctly secured; operative speeds may be set and maintained to give the maximum number of perfect impressions obtainable per unit of time; the smoothness of acceleration and steady torque of the electric motor prolong the life of the press, permit better work and minimize delays often attributable to the driving unit; all individually driven machines being independent of alignment with respect to counter shafting may as a result be arranged to secure every advantage from natural lighting facilities and be so located as to result in the most expeditious and efficient sequence of work; the substitution of electric drive results in a cleaner and more sanitary shop. In addition to the above advantages, it may be added that accident risks are decreased, it is easier to calculate productive costs, enlarged power capacities are almost instantly available, all non-productive space can be utilized, over-time work can be handled economically, fire risks are reduced and the insurance rates lowered.


Van Dorn & Dutton aerial grinder

These are but a few of the many advantages following the installation of electric drive in the printing and allied trades. The applications include such machines as presses, linotype machines, monotype machines, bronzers, stitching machines, ruling machines, perforating machines, pageing and numbering machines, folding machines, paper cutters, punching machines, etc., a number of which are illustrated herewith.

Pulp and Paper Mills

In considering the adoption of electric drive in pulp and paper mills for either a new plant or to supersede mechanical drive in an old one, the management must be assured of uninterrupted service and a definite saving in cost of production either by a low installation expense by increasing the percentage of the power developed which is actually applied to useful work or by a reduction in operating expense. It has been demonstrated in numerous instances that electric drive combines these advantages for some of the following reasons: —The location of the power plant may be selected to permit of greatest economy in generation of power. The cost of installation is less, due to the elimination or at least reduction of the heavy shafting and belting; this in turn allows of lighter structural work. The machinery can be located with a view to the elimination of all unnecessary handling of a product as each machine or group of machines can be supplied with its own motor and operated as an independent unit.

Great economy in power can be obtained where individual motor drive is adopted by the elimination or reduction of the friction losses involved in the operation of shafting, belts, gears, idlers, and other consumers of energy.

The greater part of the power used in a pulp and paper mill is of course, in connection with the grinders, but the following list is representative of the uses to which smaller motors may be put and the requirements in each case.

Motor Distribution	No.	H.P.	Drive
8 agitators	1	60	belt
3 Jordans	3	150	direct
2 Jordans	1	250	belt
3 Jordans	1	300	belt
1 Jordan	1	150	belt
2 beaters	1	150	chain
4 beaters	1	250	belt
2 washers	2	75	chain
1 washer	1	40	chain
4 screens and 4 deckers	1	75	belt
Size mixing outfit	1	50	belt
4 paper dusters	1	25	belt
Waste paper baler	1	2	belt
Hydraulic elevator pump	1	50	belt
Pump for agitators and stock tanks	1	30	belt
Stock pump and chest	1	15	belt
Stock pump and chest	1	20	belt
Boiler house pump	1	15	belt
Boiler feed pump	1	30	belt
Water pump	1	30	belt
Water pump	1	75	belt
3 paper machines constant speed end	3	75	chain
3 save-all pumps	3	10	direct
Water pump and air compressor	1	15	belt
Paper winder	1	20	belt
Paper winder	1	7.5	belt
4 super-calenders	4	75	geared
5 super-calenders	5	50	geared
1 super-calender	1	100	geared
Threading-in rolls	10	15	geared
10 paper cutters and 1 trimmer	1	30	belt
Machine shop	1	15	belt

C.W. motor driving polisher and buffer

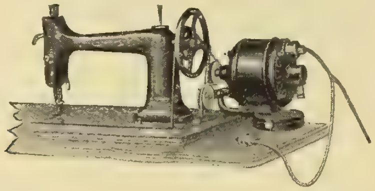
Refrigerating Machinery

In general there are two methods employed in the manufacture of artificial ice, the first known as the "can" system, which requires distilled water to produce a clear ice free from bubbles, the second the "plate" system in which ice is manufactured from the raw or undistilled water, usually in large plates. Both of these systems require compressors to supply the necessary liquid ammonia for freezing. The application of electric drive to ice making and refrigerating plants have the same advantages over steam as in all other industries. A low operating cost is assured by the steady character of the load and it is generally recognized that the quality of the product is vastly superior to that turned out by steam driven plants where the product is subject to contamination by oils, grease and dirt.

Lindstrom Smith vibrator

In addition to the actual manufacture of ice, numerous refrigerating plants are operated by electric motors, the liquid ammonia or other volatile substance being utilized for cooling a brine for circulating through the compartments to be cooled, by means of coils. The value of motor drive in each of these applications has come to be recognized.

A brief description of the plate system of ice making is of interest. The sheeted ice is formed on an artificially cooled plate used in connection with an ammonia compressor. The liquid ammonia is allowed to evaporate in a system of coils placed between the vertical steel plates which in a typical installation are 15½ ft. long by 9½ ft. wide. A cake of ice of these dimensions and 12 in. thick weighs about 9,400 lbs. A 200 h.p. motor furnishes power to the ammonia compressor which is rope driven from a large pulley located between the two horizontal cylinders. This equipment is rated at 100 tons of ice per day and it is possible to disconnect one side of the compressor, operating the other side as a single engine and thus increasing the flexibility of the plant.

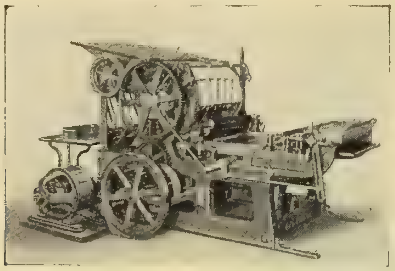


C.W. motor driving sewing machine

In order to produce ice free from air bubbles, the water is kept in motion while freezing by the use of compressed air. When the cake is built up to the desired thickness, a hot ammonia gas is sent through the pipe system, thus loosening the cake.

The tanks are arranged in two rows, each served by a 7-ton crane. To facilitate handling two-eye bolts are cast into each cake of ice. Each crane is operated by two induction motors of 5 and 3 h.p. respectively. The ice cakes are lowered to a horizontal position by means of two tilting tables. The operating motor for these tables is a 2 h.p.

The ice is now ready for the motor driven saw which is so arranged that a cut may be made in either of two directions at right angles. This saw is operated by a 3 h.p. motor and runs at about 1200 r.p.m.



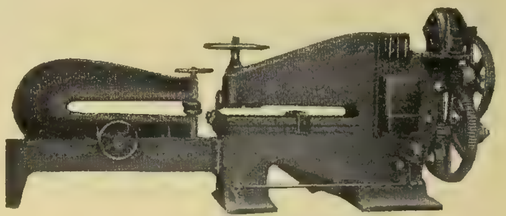
C.W. motor operated printing press

In addition to the above mentioned motors, small units of from 2 to 7½ h.p. are also used for the operation of water and brine pumps, compressors and ice elevator. One of the cuts shown herewith represents a 20 h.p. direct current motor driving a number of ice cream freezers. Another cut shows a small refrigerating plant for use in private houses or hotels.

Electric Drive in Woodworking Plants

The rapidly increasing use of electric motor drive in woodworking plants is due largely to the success which has been obtained in numerous recent installations. It has been proven beyond question that the electric motor renders the most convenient and economical service obtainable, due largely to the recognition of the value of this industry by the motor manufacturer who has endeavored to meet the particular needs of the woodworking industry by designing motors specially adapted to the operation of machines used in the manufacture of lumber products.

Among the advantages of electric drive in the woodworking industry may be mentioned a saving in the cost of production either by increasing the quantity of the product with a given tool equipment or by a reduction in operating expenses. It greatly reduces the waste of power in transmission, thereby increasing production for a given power purchase. It improves the factor of safety both to machinery and operatives; it reduces in a marked degree the fire hazard; it practically eliminates overhead shafting and belts which not only distribute dust and interfere with ventilation and lighting but frequently limit the location of machinery; it effects a reduction in the amount of floor space required. An important feature of motor drive is the ability to operate any group of machines or any separate machine over time or at usual hours without putting the whole plant into operation. This greatly reduces the cost of current. The majority of woodworking machines are operated only intermittently. The tools in general complete the cut quickly and a considerable period elapses between the completion of one cut and the beginning of another. This condition not only is the means of saving the cost of current during the off load, but the short duration of the operation enables the motors to work at overload capacity, thus reducing also the original cost of motors. Such a motor drive does not require the heavy shafting and belting inseparable from mechanical drive. The building itself may be of lighter construction as the motors may be installed either on the floor, wall or ceiling and may be connected either by short belts or direct to the drive shaft of the machine.



C.G.E. motor driven circular shears

In the application of electric drive to the modern woodworking plant, two general systems are now in vogue, namely, the operation of each individual machine by its own motor called "individual drive" and the operation of machinery in "groups" by means of line shafting, the shaft being driven by a motor and the individual machines being belted to the shaft. The relative values of group and individual drive must of course be determined in every instance by a careful analysis of the requirements of every installation, and while there are many successful examples of economical group drive it appears to be now the general opinion that in the majority of cases highest efficiency both for the machinery driven and for the motor equipment can be best obtained by the application of a separate motor to each unit.

C.W. motor driving ironing machine

This is especially true where the operation of the machines is intermittent as in this case current is being consumed only during the actual operation of the machine. Though, as said above, the choice of either group or individual motor drive must depend on local conditions, service, requirements, etc., we give herewith a typical general scheme of individual and group motor drive which would be applicable to the average woodworking plant. The size of motor generally installed for the various machines is also given as well as the method of connection.

Individual Motor Drive

Description	Method of Drive	Size of Motor
Swing Saw	Belted	3 H.P.
42" band rip saw	Direct	10 H.P.
Six-foot glue jointer	Direct	5 H.P.
30" roughing planer	Belted	15 H.P.
24" facer	Belted	5 H.P.
36" sander	Direct	10 H.P.
Back shaping machine	Direct	15 H.P.
24" planer	Belted	10 H.P.
Arm boring machine	Belted	3 H.P.
Flexible boring machine	Belted	1 H.P.
Rubbing machine	Belted	1 H.P.
60" veneer knife	Belted	3 H.P.
Double exhaust fan	Direct	30 H.P.
Two elevators	Belted	7.5 H.P. each
32" band saw	Belted	2 H.P.
Tenoning machine	Direct	3 H.P.
Double cut-off saw	Belted	5 H.P.
Shaper	Direct	3 H.P.
Jointer	Belted	3 H.P.
Edging saw	Belted	5 H.P.

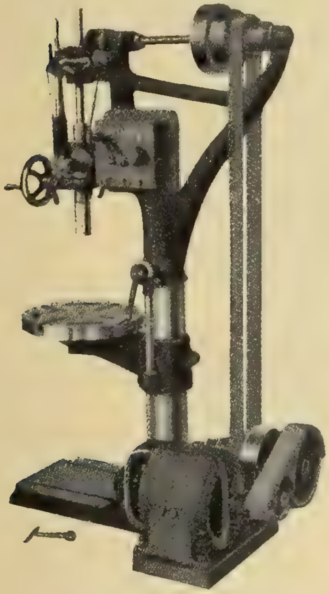
Group Drives

3 H.P. Motor—Jig saw, two boring machines.

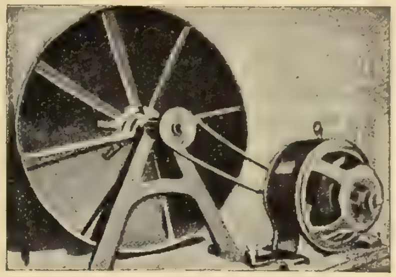
3 H.P. Motor—Saw gummer, knife grinder.

3 H. P. Motor—Cabinet saw, drill press.

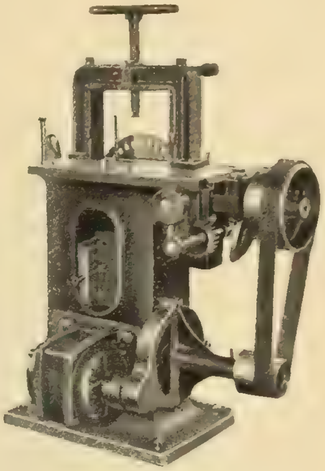
10 H.P. Motor—Disc sander, emery stand, knife grinder, carving machine, cabinet saw.



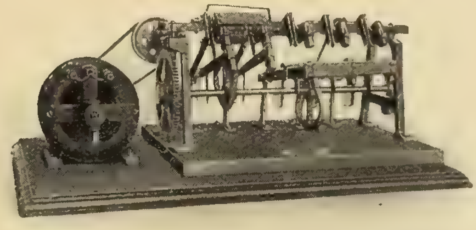
C.G E. motor driving drill press



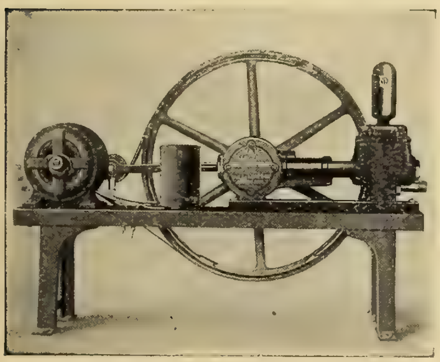
C.W. motor belted to ventilating fan



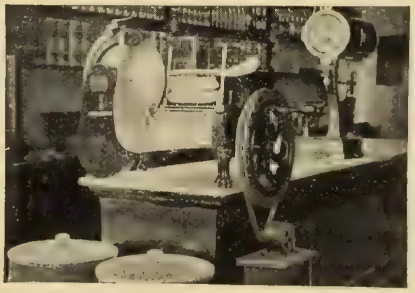
2 h.p. motor driving cold saw



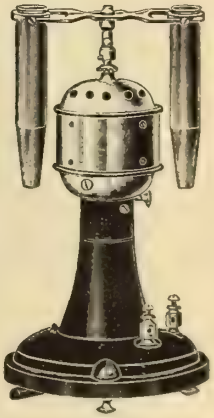
C.W. motor operating sign flasher



C.W. motor operating household pump



C.W. motor driving meat chopper



Lindstrom Smith centrifuge

The Very Small Motor

What the steam engine did for the 19th century, the small electric motor is doing for the 20th. Steam did not lessen labor, but shouldered the greater burdens of man like a giant, and similarly, the electric motor is further relieving life of the small drudgeries in home and shop, and in the field, as well as taking its part in the world's greater engineering efforts. If steam is the giant, then the small electric motor may be called the black dwarf, who does things quicker, steadier, more continuously and in tinier places than man could do them.

The range of mechanical operations that can be effected by electric motors is widening daily, and there is scarcely a position or condition for which a motor is not provided.

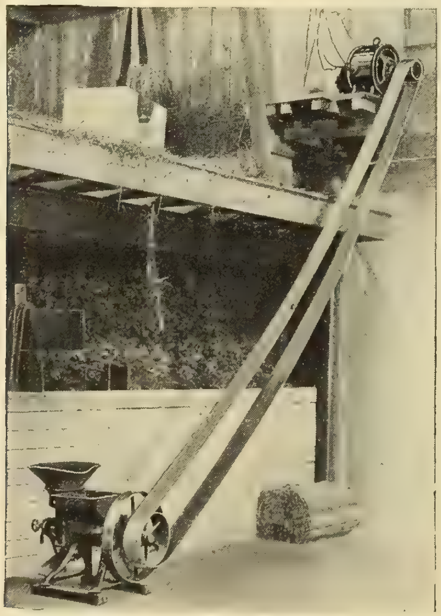
Take the homely task of washing clothes—there is a motor for that, and it does the back-breaking work of removing the dirt, while the laundress is wringing and hanging out those already washed—saving her time and strength as well. Such a motor can make itself very useful in a home if given a chance. The owner of one of these 1/8 h.p. motors bought it originally to run his washing machine. It proved such a success that he looked for other uses, and soon had it driving his foot-power lathe. Then he bought a small chuck which fitted the motor shaft and carried emery wheels, buffing and polishing wheels, small circular saws, grinding wheels and other devices, a mere recital of which suggests the possibilities of the small motor as an agency for polishing silver and other metal surfaces, grinding tools and implements, sharpening knives, etc., and doing these much quicker and better than by hand. Turning the ice cream freezer or running the sewing machine, is a mere trifle for the small motor. To a man with a workshop for either amusement or business, it is a decidedly helpful servant: running his lathe and other small tools, requiring power.

In the home, the hotel or restaurant, one of these can be put to work in a variety of ways, such as operating the washer, and wringer, washing dishes or turning the ice cream freezer, running the ironing machine, or maybe operating a small pump or air compressor, revolving the dough mixer, egg beater, meat chopper or coffee-mill, giving life to a dumb waiter, or clearing out foul vapors by a ventilating fan.

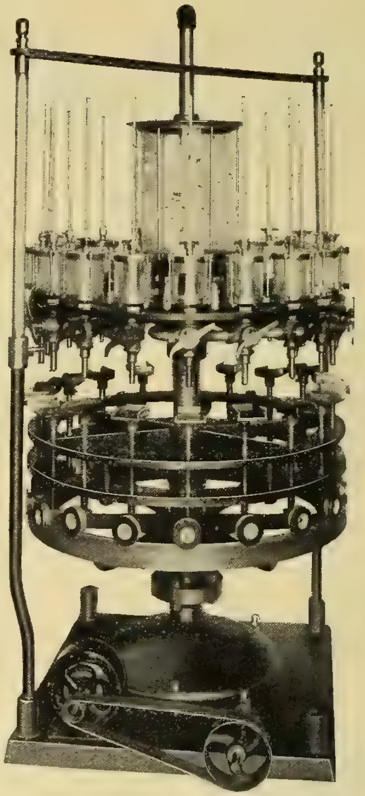
In the office, the letter opener, envelope-sealer, duplicating and addressing machines, coin counters, or adding machines, may all be worked by motor.

In the store—revolving window displays, sign-flashers, and the nimble cash carrier, depend mostly upon motor power, and the butcher's meat chopper is being harnessed to the same agency.

For the Jeweler, Optician, Dentist and Garage Manager the small motor is almost indispensable, the two latter being specially served by the operating of air compressors, or in the use of the flexible shaft,—in the one case for "painless" drilling and in the other for the cleaning and polishing of the numerous metal surfaces of his "machines." Even the humble peanut may have a better and cheaper roast handed out, and the candy spinner be given more regular gyrations by aid of the small motor than by hand—while the printer and bookbinder in running their typesetters, ruling and routing machines by small motor power can save much time and energy better employed in other operations. In a word, wherever a monotonous, constant, lengthy, turning or other regular motion is required, there the small motor does work more cheaply and better than any hand power can do it. But one of the latest and most novel applications of electric energy is in the direction of farm life: being at once a result of the extension of hydro-electric systems, and a reason for further extension thereof.


C.W. motor operating small farm grinder

Indeed the reign of the electric motor is only beginning, the reasons in its favor are so many: among them, compactness as compared with boiler and engine, sustained energy, easy control, greater safety, quiet and cleanliness, and the fact that they can be placed on walls and hung from ceilings. Then there is low operating cost,—any device requiring the strength of a full-grown man to operate, can be driven all day by one of these motors for a very few cents, and the cost ceases when the motor stops. Another point is, that by using motors instead of steam power you apply only the power needed and only where it is needed, greatly reducing cost of production. These motors may be had from 1-10 h.p. up, in various fractions of a horse-power and on, up to the big motor class.


Century motor driving bottle filler

Supplementary Summary

In order to better emphasize the general applicability of the very small motor the following list of suggestions is appended. This list may be considered as supplementary to the uses that have been already outlined although it is true that in particular instances overlapping will occur. Our idea in reproducing it is, in part, that it may be of assistance to the business solicitor. One or more of the lines of business mentioned in the list is carried on in every city, town and village on this continent and though it will often not be found possible to drive all the machinery in any establishment by motors, there will generally be some single machines which are intermittently required and to which electric drive will appeal, to the owner, as being especially applicable. If the list is helpful it serves our purpose of reproducing it here; if it is incomplete, the reader is at liberty to add to it, and for such omissions we make no apologies.

Addressing—Addressing machines, paper cutters, printing machines.

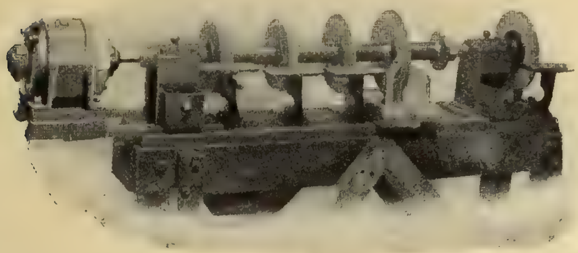
Bicycles—Blowers for brazing, buffs, drills, emery straps, emery wheels, lathes, saws, whips.

Blacksmiths—Drills, fans, forge blowers, helve and trip hammers, lathes, punches, shears, whips or hoists.

Blank Books—Fans, paper cutters, printing presses, ruling machines, smashing press, whips.

Book Binders—Drying fans, embossing presses, freight hoists, paper cutters, smashers, stitchers, ventilating fans, whips.

Bottlers—Bottle cleaners, fans, hoists or whips, pumps, wiring machines.



1 h.p. motor driving Grinding set

Carpenters—Band saws, circular saws, exhaust blowers, grindstones, hoists, jig saws, lathes, molders, planers, ventilating fans.

Clothiers—Cloth cutters, sewing machines, ventilating fans.

Cigar Manufacturers—Branding machines (requiring small motors), ventilating fans.

Coffee Mills—Cleaners, exhaust fans, grinders, roasters, ventilating fans, whip hoists.

Confectioners—Candy pans, chocolate mills, cream stirrers, cutters, exhaust fans, grinders, kiss cutters, mixers, pressers, rolls.

Cutlers—Blowers, buffers, cold saws, drills, exhaust fans, grinders, hoists, punches, shears.

Dentists—Buff wheels, drills, fans, grinders, lathes, saws.

Drugs—Drug mills, fans, grinders, whips.

Dry-Goods Stores—Cash carrier systems, fans, sewing machines, whips and hoists.

Electrotypers—Brush wheels, circular saws, drills, drying fans, electroplating machines, generators, planers, routers, ventilating fans.

Engravers—Drills, routers, saws.

Gas and Steam Fitting—Buffs, fans, lathes, pipe cutters, presses, threading machines, whips or hoists.

Gas Fixtures—Blowers, buffs, fans, hoists, lathes, saws, whips.

Grocers—Coffee mills, fans, hoists or whips.

Harness Shops or Saddlers—Buffs, fans, rollers, sewing machines, skivers.

Hotels—Dish washers, dough mixers, exhaust fans, ice and refrigerating machines, ice cream freezers, knife grinders, laundry machines, meat choppers, pitcher cleaners, ventilating fans.

Jewelers—Blowers, buffs, lap wheels, lathes, ring machines, ventilating fans.

Knit Goods—Braiders, button machines, knitting machines, looms, sewing machines, ventilating fans, whips.

Newspapers—Blowers, fans, form hoists, linotypes, pneumatic tubes, presses, routers, saws.

Opticians—Blowers, drills, exhaust fans, grindstones, lap wheels.

Paper boxes—Automatic box machines, die machines, fans (drying and ventilating) presses, saws, whips.

Paper Dealers—Fans, gumming machines, paper cutters, perforators, ruling machines, whips or hoists.

Printers—Cylinder presses, form elevators, job presses, linotypes, paper and form hoist, paper cutters, ruling machines, stitchers, type bar machines, ventilating fans.

Repair Shops—Fans, forge blowers, sundry machinery, whips.

Restaurants—Coffee grinders, dough mixers, grindstones, ice cream machines, knife cleanser, laundry machinery, meat choppers, pitcher cleaners, ventilating fans.

Saloons and Cafes—Ice cream freezers, ventilating fans.

Shoemakers—Buttonhole machines, edgers, Goodyear machinery, McKay machinery, rollers, sewing machines, skivers.

Shirtwaist and Dressmakers—Cloth cutters, fans, sewing machines.

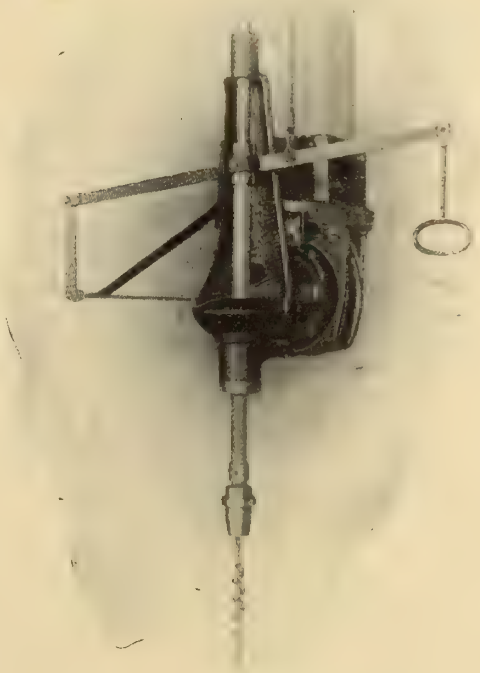
Silversmiths—Blowers, buffs, drills, fans, lathes.

Stationers—Fans, paper cutters, perforators, printing presses, ruling machines, whips or hoists.

Tailors—Cloth cutters, fans, sewing machines.

Tin and Brassware—Blowers, buffs, drop press, fans, grinders, presses, punches, straighteners for wire and plate.

Tobacconists—Cleaners, cutters, fans—exhaust and ventilating, hoists and whips, presses, shredders.



2 h.p. C.G.E. motor driving wood borer

Umbrellas and Canes—Buffs, lathes, presses, saws, sewing machines.

Public Buildings—Ventilation, air purification, water circulation, hoists, forced drafts, pneumatic tubes.

Medical Purposes—Vibrators, centrifugal machines.

Music Stores—Music boxes, player pianos.

Modistes—Vibrators, polishers, hair dryers.

Barbers—Head massage, hair dryers.

The government telephone line in the interior of B. C. is to be extended to Chase and the district near Shuswap Lake.

The sixth regular meeting of the Toronto section of the A.I.E.E., was held on April 25th, 1913. The meeting was addressed by Mr. E. E. F. Creighton, of the General Electric Company, Schnectady, on the subject of "Electrical Protection."

ELECTRIC RAILWAYS

Wreckless vs. Reckless Railroading

A movement has recently been organized by the Canadian Pacific Railway Company with the object of emphasizing the value of caution in every phase of railroad work. The movement has been named the "Safety First" movement and is said to have been adopted by over forty prominent railway systems in the United States covering some 150,000 miles of line. We reproduce herewith sections of a paper recently read by Mr. N. S. Dunlop, claims adjuster of the Eastern Section of the C. P. R., before the Canadian Railway Club, and although this paper was prepared specially with steam roads in mind there is so much community of interests between steam roads and electric roads that the ideas expressed by Mr. Dunlop are almost equally applicable to the latter. This movement is apparently, and we believe justly, meeting with wonderful popularity among the employees and patrons of all the roads adopting it and we think its application may well be extended, not only to our electric roads but to practically every form of industrial activity of the present day. In the discussion which followed the greatest enthusiasm was expressed by everyone who had made a study or had noticed the results of this form of missionary work. Mr. R. M. Hannaford of the Montreal Tramways Company expressed himself as being of the opinion that this paper was of vital importance to all electric railways as well as steam railways, and stated that they were making a special campaign on behalf of the "Safety First" idea and were issuing blotters and reading matter to the public and asking their co-operation.

"Safety First"

The claims adjusters of all the railways in America, who have to follow the investigation of every accident to employees and the public, and finally settle the claims arising therefrom, are credited with originating the "Safety First" plan among railway employees.

They had a strong feeling that if the large number of avoidable accidents and serious injuries to employees were pointed out to them, they would immediately see the necessity for adopting "Safety First" measures for their own personal safety.

According to the report of the United States Interstate Commerce Commission, and the report of the Railway Commission for Canada, for 1911, there were 3,865 employees killed and 130,158 injured—more than 10 employees killed and 3,562 injured every day in the year. A man killed, or injured, about every 24 seconds.

Now, who is paying this appalling toll? Not the public, not the officers, not the clerks. The men who are paying this toll are the men on the firing line in every department of operation, and a close investigation and observation, extending over many years, has shown that from 60 to 90 per cent. of these accidents are preventable, and occur through men taking chances.

Every time a serious accident happens, the doctor, the nurse, the minister, and the priest are called to the home, and injuries mean suffering, sorrow and expense. Every time you take an experienced man out of the service, you put an inexperienced man in the service, somewhere, and you not only increase the accident risk to men in the service, but you lessen the efficiency of the whole organization.

The Canadian Pacific Railway adopted the "Safety First" scheme more than a year ago with good results. Fourty-four prominent railways in the United States and Canada have adopted the plan covering 144,329 miles of railway.

In each district committees are formed with a chairman and secretary, and members from every department of operation serve on these committees and hold meetings regularly. The committees are composed of superintendents, agents, engineers, firemen, conductors, trainmen, yardmen, trackmen, freight porters, checkers, roadmasters, sectionmen, etc., etc. Every department has a right to be represented, and every employee of the railway is expected to be a "Safety First" man.

Most of the railways have adopted a "Safety First" button, worn by the committee men, and in many cases employees are asking that they be supplied with buttons, to demonstrate their interest in the subject, by wearing them at all times.

If the committee meetings are held during working hours, the committee men are allowed their time and their expenses, if they are away from home.

Any employee interested in the "Safety First" movement who sees anything which might lead to the loss of life, or injury to a fellow employee, either corrects that defect at once himself, if he is able to do so, or reports it to a member of the "Safety First" committee for discussion and immediate action. Anything which can be corrected by the superintendent, or other officer in charge of the department, is attended to at once, and if the matter involves considerable expense, or changes in plans and policy, it is reported to the general, or central committee, for discussion with the management.

Literature is distributed among the employees calling upon them to be careful at all times and not to take chances.

"Safety First" means a wise selection of men and educating them to believe that "Safety First" is simply a habit. Men are taught to think first and act afterwards. They are educated to look out for unsafe conditions. They are enjoined to do the safe thing always, and to remember that it is better to let a train wait than to cause an accident.

The investigation of accidents shows that it is the little thing which many people do not bother about that leads up to a serious accident.

"Safety First" says emphatically "do not take chances." The time between the prevention of an accident and causing one is only a matter of a few seconds.

The careless, indifferent foreman will have careless men under him, and a greater number of accidents than the man who is always alive to "Safety First."

The conductor's highest duty is the protection of his passengers and he should exercise great care in the starting and stopping of his train, and live up to the very spirit and letter of the rule book.

All men engaged in the operation of trains should at all times observe the strictest sobriety, have proper rest, know the rule book by heart, and observe without any quibbling, every rule in the book. They should have no family troubles, and while on duty think of nothing else but duty.

If in doubt, stop. It is better to delay your train than land yourself and your passengers in eternity.

Men should tell their fellow employees of the dangers of their work before an accident happens, and warn them how to avoid it.

Never approve the actions of careless men. Caution them for their own good and for the good of others.

The vast importance of "Safety First" is demonstrated in the words themselves. You may write volumes on these two words, analyze them describe their objects, explain them any way you like, but you cannot add to the emphasis of that slogan which is bound to reach more railway men, and be of vastly more importance, than any subject they have ever taken up.

On a large number of railways special men have been appointed whose duties are solely to educate the men on "Safety First" habits. This is done by printed literature, lectures, moving pictures showing the right and wrong way of doing work, correcting defective conditions and impressing upon the minds of all classes of employees the danger of taking chances.

In the operation of a railway "Safety First" should be placed above everything else. Unless men are willing to be careful and avoid injury to themselves and their fellow workmen, they should not engage in railway work. A railway does not want careless men in its employ "Safety First" is always a great convenience, but in an emergency it is an absolute necessity.

The "Safety First" habit must be the creed of every railway man who hopes to succeed in the prevention of preventable accidents.

Do not allow telephone or telegraph wires to hang too low over tracks. Cut them before some poor fellow is knocked off the top of a car and paralyzed for life.

Whenever an employee is killed, or injured, sorrow, suffering, expense, and, if he lives, crippled earning power, is the result.

Do not allow a man with one eye to work where cars are being moved. He cannot see from the blind side.

"Safety First" never sleeps. It says: "Report and have corrected as soon as possible anything which would cause an accident." It calls at all times for suggestions and ideas, from employees, how to save men's lives and limbs.

"Safety First" is not started with a view to fault finding, or tattling on employees. Every employee is a member of "Safety First," and when he realizes that he cannot evade some responsibility, directly or indirectly, whenever a fellow employee's life is sacrificed, or an injury comes to him, he will report to his committee, or superior officer, anything which he sees might cause an accident to an employee, or the public.

The chance taker is a widow maker and an orphan maker.

Do not scoff at "Safety First." It is pounding an anvil chorus on your ear drums to-night, craving and begging for your interest and support in a movement which should have the consideration of every railway man, every man engaged in industrial pursuits, no matter in what department he is employed.

The "Safety First" habit is spreading. Get the "Safety First" habit. Practice it on every occasion, in matters little as well as momentous, until it becomes second nature, automatic, like the air brake, so that a departure from the safe course would jar your conscience into wakefulness and arouse conscience.

It takes less time to prevent an accident than it does to write a report explaining how it happened.

Greater safety means greater efficiency in operation. There is real dignity in "Safety First." It displays character, manliness, education and energy.

Many accidents are not inevitable. The great majority of them are preventable and can be avoided with care.

The most important factor in the operation of railways for all time to come will be men.

"Safety First" teaches them not to take chances, not to sell their lives and limbs cheaply and foolishly by taking chances.

Victoria to Deep Cove

Announcement was recently made by the management of the British Columbia Electric Railway Company that on May 15th the interurban line from Victoria to Deep Cove will be placed in operation.

This line extends from the city of Victoria, Vancouver Island, for a distance of 23 miles to the north. It passes through the centre of the Saanich Peninsula which is an arm of land at the southeastern corner of the Island with the Gulf of Georgia on one side and the Saanich Inlet on the other. The district is capable of great development as an agricultural centre and also provides admirable facilities for the location of suburban homes. The Victoria press unite in stating that the opening of the district by the interurban line will do more to advance the growth of the country surrounding Victoria than could be done in any other way.

The line will be the second longest interurban line operated by the B. C. Electric, the longest division of the company's system being that from Vancouver to Chilliwack, a distance of 76 miles.

The B. C. Electric controls several large holdings along the route of the new line and these will be developed as model townsites. It is also probable as the district develops, that a good freight business will originate along the line, milk, produce, etc., being brought from the agricultural sections to supply the needs of Victoria. Plans are already being made for the location of industries along the line and two large cement plants are already located at points which will be tapped by the route.

The rolling stock which has been allotted to the line consists of 4 passenger cars, 2 baggage and express cars, 1 45-ton locomotive and 25 box cars. It is proposed to inaugurate the service by the operation of 2 train cars, with 3 train cars being used as the business develops. Locations have been allotted for about 20 stations along the line, located about a mile apart, Shuttle structures of the usual interurban type will be provided at each of these points.

The Burnaby Franchise

The Burnaby Municipal Council is submitting to the electors a tram franchise by-law in favor of the British Columbia Electric Railway Company, April 26th, being the day set for a poll on the measure. The by-law provides that the company shall construct extensions of its lines on Hastings street, east from Vancouver and an extension of its New Westminster city lines along the North Road. The term of the franchise will be about 36 years, the general terms of the agreement being similar to the franchise agreement under which the company now operates its system in the municipalities of South Vancouver and Point Grey.

The British Columbia Electric Railway was granted a 40-year franchise in Burnaby by the Municipal Council in 1909. With the passage of this measure the company constructed a line passing through Burnaby and connecting Vancouver with New Westminster, this line being now in operation. In 1911 a question was raised as to the validity of the company's franchise in Burnaby because of the fact that the agreement was not ratified by the electors. The question was taken into the British Columbia courts and last year Mr. Justice Murphy rendered a decision stating that the franchise was valid. Notice of an appeal from the decision of the B. C. court to the Privy Council has been given by the municipality. In the meantime negotiations were carried on which have resulted in the forming of the franchise upon which the Burnaby electors will vote on April 26th. The passage of the measure will naturally result in the municipality abandoning its appeal to the Privy Council. Should the measure be defeated, the company will press before the

Privy Council for a decision that its franchise granted in 1909 is valid.

The municipality of Burnaby is now developing very rapidly and the district touches both Vancouver and New Westminster, and suburban settlement for these cities is steadily advancing from either boundary. The terms of the tram agreement now proposed by the B. C. Electric will do much to assist in the development of the district.

B.C.E.R. Extensions

Announcement has been made by the B. C. Electric Railway as to certain tram extensions which will be made in the territory covered by the company during the present year.

In Victoria the company propose to construct a line from Pandora avenue along Quadra street to Bay street and thence easterly to Shelbourne street, the route serving the suburban section of the city which is now rapidly developing.

In South Vancouver the company proposes to lay an extension of its track on Westminster road nearly a mile in length, provision being made for further extending the line along Westminster road to the limits of the municipality in the future. This track will be a permanent type and will be laid in connection with permanent pavement which will be constructed this year.

Another extension to the company's line in South Vancouver which is planned for 1913, is a line connecting the South Vancouver lines with the city line terminating at Cedar Cottage, a point located in the extreme southeastern part of Vancouver. This line will run from Westminster road to Cedar Cottage and will be nearly a mile in length.

Rolling Stock for 1913

The additional rolling stock which will be demanded for the lines of the B. C. Electric Railway during 1913 will represent an expenditure of over $750,000.

The principal item of the Company's 1913 budget for rolling stock consists of 65 passenger cars, an order for which was placed with the Preston Car & Coach Company during the latter part of last year, delivery of which is to be made during the coming summer. In addition to these cars there will be demanded for city service 16 passenger cars. Over its interurban lines the company will require three additional passenger coaches, 3 baggage and express cars and 2 combination mail cars, the latter probably being constructed in the company's shops from equipment now on hand.

For freight service of the company the demands call for 50 box cars, 30 flat cars and 25 steel dump cars. The company's plans also call for the purchase of 3 snow sweepers.

During the month the company has received 2 50-ton locomotives from the Westinghouse Company, Pittsburg, this equipment having been ordered last year. The locomotives are of the latest type and will be used on the Fraser Valley division of the company's lines.

Fender Stood the Test

Early in April an interesting test of a new automatic street car fender took place at Vancouver before several B. C. Electric Railway officials, and the officers of the United States company owning the patent. Previous tests of this fender, which was first used on the Portland, Oregon, street railway system, proved that the device works either on contact with a person or can be controlled by the motorman from the car cab. Compressed air supplied by the same compressor that compresses air for the air brakes is used to operate it. Among the features claimed for this fender are: that it can be folded back against the car when it is necessary to couple two cars, that it is very quick in action, and operates under any circumstances.

For the tests at Vancouver two dummies were used, one wooden, which was the first used. It was placed on the track in a sitting position and the car run toward it at a fair rate of speed. The dummy was lifted right off the pavement, and kept entirely clear of the wheels or other moving parts of the car. The same dummy was then put in a standing position; the same result was apparent. In the first test the fender was allowed to work automatically, and in the second instance the fender was lowered by the motorman.

The stuffed dummy was then brought into place and put in several positions on the track; all the tests were successful. Mr. F. A. Nelson, inventor of the device, was present at the trial.

Montreal Car Service

All reports and suggestions for improving the Montreal car service have been placed in the hands of Mr. G. Janin, the city engineer, and Mr. McLeod, assistant engineer. Mr. Robert, the president of the Tramways company, has also been in conference with the Board of Control, at which the former made certain suggestions for relieving the congestion, and promised later to submit plans providing for future development. Rolling stock is to be increased as fast as possible, the tracks are to be repaved, and certain lines relaid.

Reduced Lighting Rates

On April 1st the B. C. Electric Railway Company granted a reduction in the private lighting rates for Hastings townsite and D. L. 301, two districts adjacent to Vancouver. These sections were recently annexed to the city but a regular suburban lighting rate has prevailed in the territory until this time. The new rates place the districts on the same basis as the Vancouver city rate. The old rates ranged from 15 cents per kw. hour for the first 50 hours to 8 cents per kw. hour for over 2,000 hours. A monthly meter rental of 25 cents being charged. The new rates are 11 cents per kw. hour for the first 50 hours ranging down to 4 cents per kw. hour on consumption over 2,000 hours, with a monthly meter rental of 15 cents. About 1,300 customers are affected by the change.

Enlarging the Aqueduct

Tenders have been invited by the Montreal City Council for the widening of the aqueduct from Point St. Charles to Lachine, a distance of six miles, at an estimated cost of $2,000,000. The city have already spent this sum on the conduit alongside the aqueduct and the preliminary widening, which in its present condition will supply 6,000 horse-power, to be used for pumping. The new work to be undertaken will enable an additional 4,000 horse-power to be generated, and this will be utilized for the lighting of the city. No plans for the electrical equipment have yet been made, but the intention is to replace the present steam plant, and to use it as a reserve. The width of the aqueduct will be about 174 feet on the water line, and 145 feet at the bottom. Concrete retaining walls will be constructed the entire way. The excavated channel will be about 16 feet deep.

The Electric Railway Equipment Company announce that owing to increased business, they have been compelled to secure larger quarters for their eastern office, and that after May 1st, it will be located at 30 Church street, Hudson Terminal Building, New York City. Mr. J. G. Kipp will remain in charge. It is stated that since the opening of their eastern office this company have been doing a very gratifying business, as they are now in a much better position to handle export trade.

Illumination

Luminous Arc Lamps

The long burning luminous arc or magnetite arc lamp is becoming so popular on account of its efficiency and its adaptability, especially for street lighting, that we present herewith a description of the mechanism of the lamp with a few comments on its characteristics.

The name Luminous Arc arises from the fact that the light is produced from the incandescence of the arc itself instead of the incandescence of one of the electrodes, as was the case largely with the old carbon type of street arc lamps. The positive electrode of the magnetite arc is pure copper. The negative electrode is made of a mixture of oxides of different metals of which magnetite, an oxide of iron, is the one which gives to the electrode its properties of conductivity and long life. The arc issuing from this compound electrode is intensely brilliant and blueish white in color, and is surrounded by a concentric envelope of solid particles which appear on close inspection as a yellowish luminous flame.

This lower, negative electrode is in appearance an iron tube filled with a heavy black powdery mineral substance. As stated above, iron in the form of the oxide is relied upon chiefly as the carrier of the current. The oxide used is known as magnetite and has the formulae FeO, Fe_2O_3, which has a metallic content of over 72 per cent. As magnetite gives off, itself, a comparatively small amount of light, it was necessary to mix with it a light-giving substance, and search was made for the one in which the same amount of energy produces more light in the arc than any other substance known. The particular substance which has been found, with magnetite, to increase the luminosity of the arc to the greatest extent is a dioxide of titanium known popularly as rutile and having a formulae TiO_2. The titanium is sometimes introduced chemically, combined with the iron in which case more even operation of the arc results. It has further been found that by the introduction of chromium, the life of the electrode is greatly increased. Chromium also is generally introduced in the form of an oxide though a mineral called chromite which is a double oxide of chromium and iron and has the formulae FeO, Cr_2O_3 has been found most satisfactory. These minerals after being prepared in great purity, are carefully crushed between hardened steel rolls. After their passing through a screen of great fineness, the mixture is passed under the poles of a magnetic separator to lift any magnetite or other magnetic impurities.

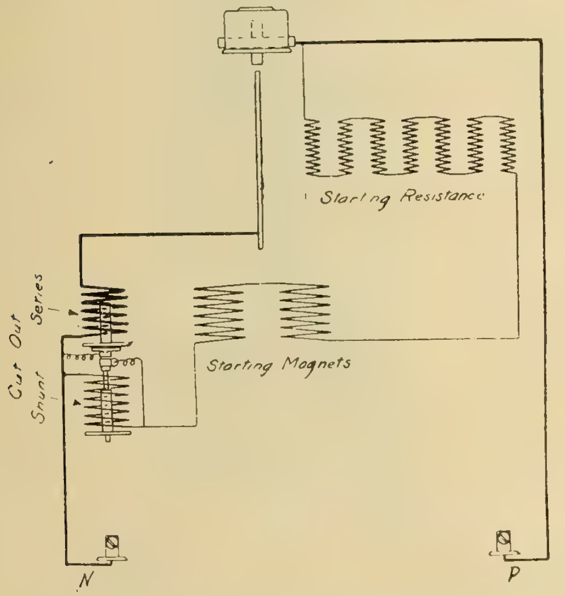


Fig. 1. Connections of Luminous arc lamps,

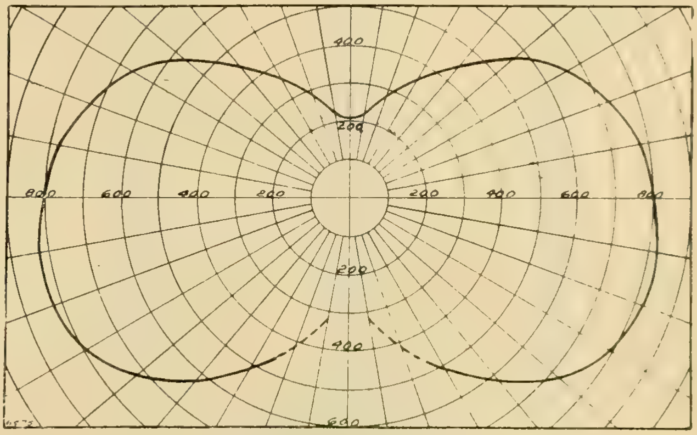


Fig. 2. Curve showing light distribution.

The process of filling the iron tubes with a mixture of iron, chromium and titanium oxides is called loading. In this process electrically welded iron tubes with tightly fitting steel thimbles at the lower ends are packed into a machine which is so constructed and operated that a moving element is slowly lifted several inches and then dropped upon the heavy base of the apparatus. During the loading of a standard luminous electrode about 3,000 impulses are delivered by the loading apparatus during which time the luminous mixture is slowly and evenly delivered to the filling machine. After the electrodes are loaded they are thoroughly dried in a steam heated oven at a temperature of 150 deg. C. for 24 hours. The upper end of the electrode is then closed with a moisture proof and dust proof seal and covered with a thin disc of sheet iron to insure perfect contact with the upper electrode when the lamp is first started. They are then given the protecting coating of oil to keep the sheath from rust.

When operating at standard adjustments (6.6 amp. at 75 to 80 volts across the arc) the life of the lower, or magnetite, electrode is from 150 to 175 hours and that of the upper or copper electrode from 3,000 to 4,000 hours.

The wiring connections of a series luminous arc lamp of the inverted type is shown in Fig. 1, from which the cycle of operation may be understood. The current enters the terminal P, passes through the starting resistance, starting magnets and the cut-out contacts to the negative terminal N. The starting coils are those energized and the lower electrode is brought into contact with the positive establishing the arc, and the circuit, through the series cut-out coil. This coil, on becoming energized, separates the contacts and opens the circuit through the starting coils thus allowing the lower electrode to fall back to its normal position, retarded by the dash-pots. The electrodes remain in this position until for some reason the voltage at the arc momentarily reaches a point sufficiently high to actuate the shunt magnet, when the contracts are once more closed and the cycle of operation is repeated. The standard magnetite electrode measures 9-16 in. in diameter by 15 in. in length.

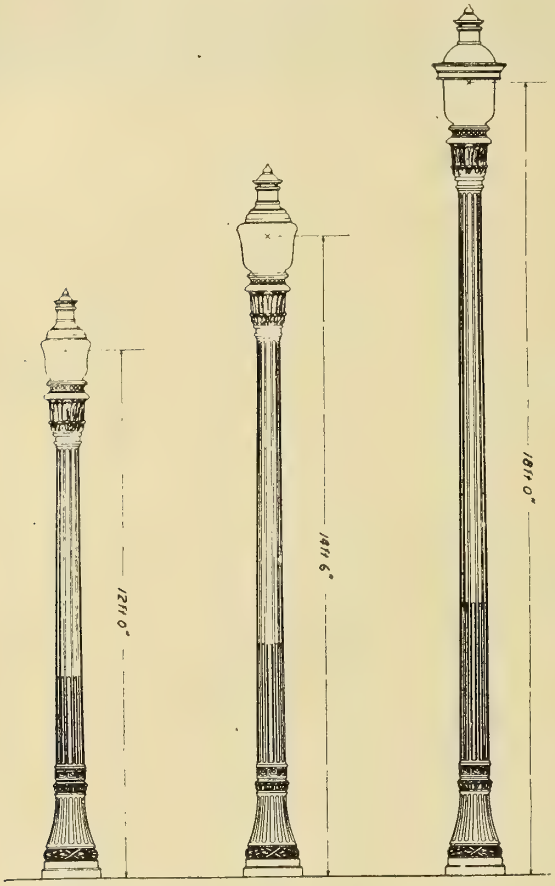


Fig. 3. Three types of luminous arc units.

As already stated this lamp has now been adapted admirably for ornamental street lighting. The distribution of light is unusually good, the greatest intensity occurring from 10 to 30 deg. below the horizontal plane of the lamp, thereby giving a very uniform illumination over a maximum of street area. At the same time sufficient light is given above the horizontal plane to illuminate adjacent buildings in all their detail. The photometric curve shown in Fig. 2 illustrates the excellent distribution obtained.

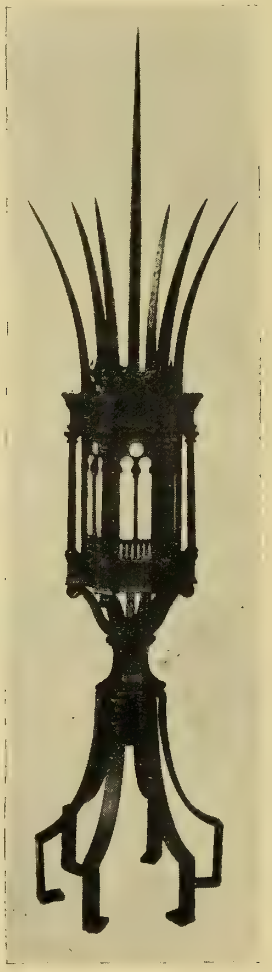
In the ornamental type of lamp the trimming operation is simple as the removal of the globe is unnecessary. Only one electrode requires renewal. To accomplish this, the chimney is raised and swung to one side, leaving the lower electrode exposed. After trimming, the chimney is simply raised and swung back into its position.

This lamp has now been standardized in three forms of ornamental luminous arc lighting units (1) known as the Great White Way lamp, in two forms, consuming 520 watts at 6.6 amp. and 320 watts at 4 amp.; (2) the residential lamp consuming 300 watts at 4 amp., and (3) the Parkway lamp designed for operation at both 4 and 6.6 amps., consuming 300 and 500 watts respectively. These three types of lamp are exemplified in Fig. 3.

As these lamps operate only on direct-current, it is necessary in towns and cities where alternating current only is distributed that some sort of rectifying apparatus be installed. A motor-generator is often used but owing to the fact that the mercury arc rectifier possesses many advantages, including higher efficiency, this type of apparatus is coming into very general use. The life of the mercury arc rectifier varies greatly though a life of over 7,000 hours has been obtained.

Unique and Handsome Fixture

A lighting fixture of particularly unique and handsome appearance is shown herewith. A pair of these has recently been installed by Mr. Warren Y. Soper, of Ottawa, at the entrance to the grounds of his private residence "Lorando," Rockcliffe Park. Mr. Soper recently returned from a trip abroad and while in Italy he espied this unique design, the product of a famous Italian artist of the 16th century, the original of which is still to be seen in the Strozzi Palace of Florence. The beauty of the design so impressed Ottawa's electrical magnate that he returned to his native city with a model of the original from which he has had two reproductions made and placed as indicated above. The construction work was taken in hand by the Ottawa Car Company, who have reason, with Mr. Soper, to be proud of the artistic result. Fortunately the lamps will not be equipped with candle dips or any similar illuminant of the middle ages, but give out real day-light by the liberal use of the modern tungsten lamp. The electrolier as shown, stands approximately 9 feet in height.

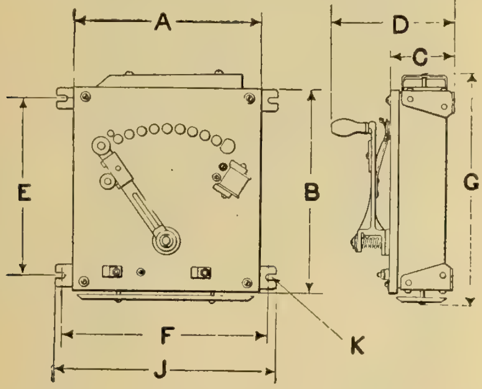


Fixture of handsome antique design.

The Dealer and Contractor

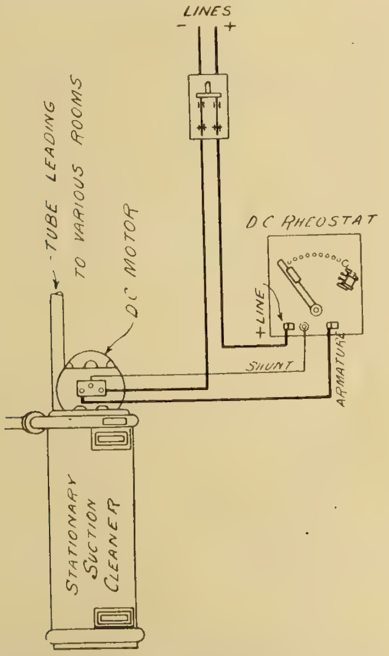
Control of Stationary Suction Cleaners.

The growing use for suction cleaners of the stationary type has created a demand for a variety of control which the electrical contractor sometimes finds himself at a loss to supply on the spur of the moment. Some of the machines are started by hand operated rheostats but the majority use self starters capable of control from one or more points located advantageously throughout the building to be served.



Dimension diagram of rheostat.

Beginning with the present issue, we propose to reproduce a number of diagrams showing the wiring arrangements necessary. The present reproductions refer to the most elementary installation possible, a direct current equipment using hand starting rheostat. A simple diagram of the rheostat is shown in dimension for horse powers from 1 to 50 and voltages from 115 to 500. Under these conditions A varies from 8 in. to 16 in., B from 9 in. to 18 in., C from 2⅞ in. to 12¼ in., D from 5⅞ in. to 18¾ in., E from 7⅞ in. to 20⅛ in., F from 8⅞ in. to 19 in., G from 8⅝ in. to 22½ in., J from 9½ in. to 20 in., K from ¼ to 7-16 in. These dimensions have reference to controllers manufactured by the Cutler-Hammer Company, specially for the Tuec suction cleaner.



Wiring diagram of simple installation.

The wiring diagram shown herewith represents the simplest form of electrical installation for the operation of a stationary motor. In this case it will be seen that the motor can only be started and stopped at the controller. While this arrangement possesses the advantage of simplicity and low first cost, these may easily be offset by increased operating costs due to carelessness in having the motor running longer than is necessary.

New Benjamin Button Surface Switch.

The accompanying cut illustrates a new type C-H surface switch recently put on the market by the Benjamin Electric Manufacturing Company of Canada, Liimted, who manufacture all Cutler-Hammer wiring devices in the Dominion. This new round base switch, used with concealed or open wiring, has been designed because of the demand for a small surface switch of good appearance. The small and ingenious C-H mechanism permits of operation by means of a single piece push button bar which is part of the mechanism. There is no protruding key to lose or break off. The push bar operates in a straight line and no twisting or turning is necessary. The button of the ordinary snap switch is often turned the wrong way by those not familiar with electric switches or by those mischievously inclined. This is not possible with C-H push button switches. The buttons do not protrude from the front of the cap. The switches may be furnished either with plain face or with label holder for labeling circuits and lamps controlled. The diameter of the switch is only 1¾ in. and the overall depth 1⅝ in, the extra ¾ in. taken up by the usual operating button extending from the cap is eliminated.

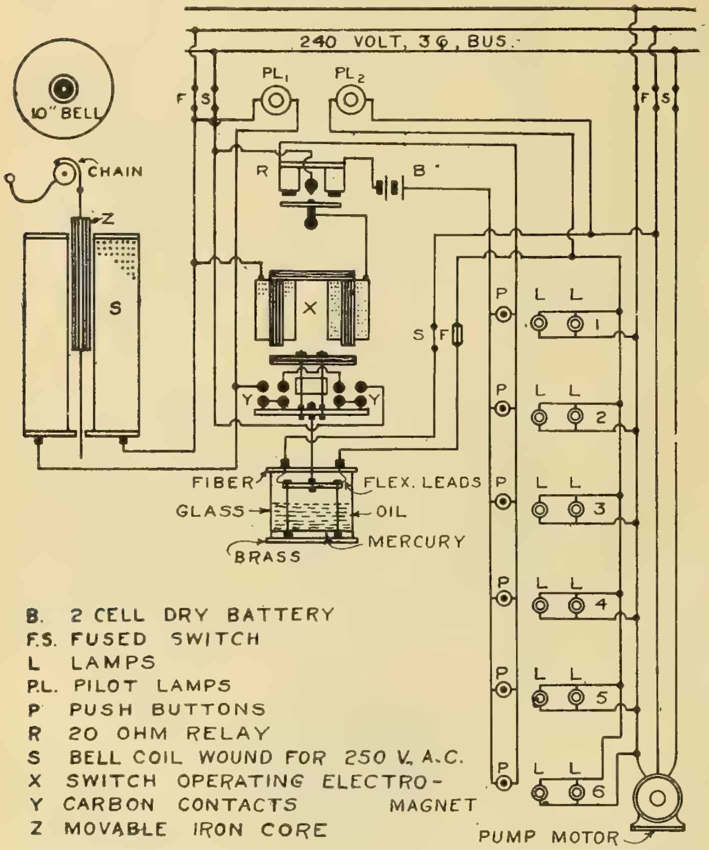
Button surface switch.

Messrs. Waugh, Mesner & Bailey, of Vancouver, have completed the installation of 219 ornamental light standards on Main street, Granville street south, Hastings street east, and Harris street, Vancouver. The standards are exactly similar to those already in use in other parts of the city, and are equipped with five 100-watt tungsten lamps, wired in multiple at 110 volts on 3-wire system.

Electric Mine Signal System.

The accompanying sketch represents the wiring diagram of an electric mine signal system devised by Mr. Elvin F. Brough, of Sulphide, Ont. The system was placed in operation over two years ago and is giving entire satisfaction.

Reference to the sketch will show that by pressing the button on any one of the different levels it closes the circuit from the battery B through the standard 20 ohm telegraph relay R. This in turn closes the line from the 240 volt bus through the switch operating electro-magnet K which is an iron core built up of stove pipe iron to 1 in. square and wound with 1,500 turns of No. 22 S.C.C. wire. This attracts the armature to which are attached four of the carbon contacts Y and also the plunger of the mercury dip switch. When the circuit is closed through the carbon contacts it allows the line current to go through the bell coil S. This, acting on the core Z, pulls the chain over the wheel to which is attached the bell hammer. By this arrangement a long and powerful stroke is given to the bell.



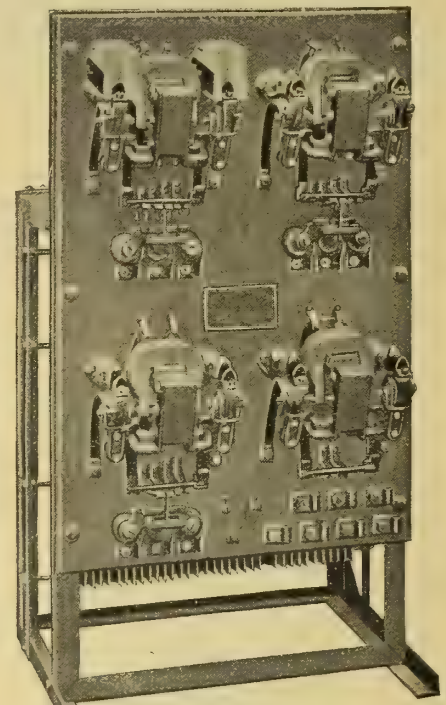
Wiring diagram of mine signal system

When the armature of X is up it will be noticed that the mercury dip switch is open so that all the lights down the shaft are out as long as the button is pressed. The advantage of this is easily seen as the signals given from any one level can be read at every other.

The pilot lamps P_1 and P_2 are connected up so that P_1 lights and P_2 goes out when the bell rings.

Self-Starters for Alternating Current Motors.

Automatic or self-starting equipment is particularly advantageous for motors driving reciprocating pumps, air compressors and other machines that must be started under full load and which require a starting torque equal to or in excess of the normal full load torque of the motor. By the use of the new type of polyphase motor self-starters made by the Cutler-Hammer Manufacturing Company, Milwaukee, and shown in the accompanying illustration, the motor can be safely accelerated in the shortest time consistent with a predetermined starting current. The acceleration is controlled by resistance in each phase of the rotor circuit and balanced on all steps which is cut out of circuit by magnetic switches. The closing of these switches depends upon the action of three-phase current relays in the rotor circuit, which allow successive steps of resistance but cut out only after the current has dropped to a safe value and the motor properly accelerated.



C-H polyphase motor self-starter.

These self-starters are of the multiple solenoid type entirely self-contained, made in standard capacities up to 200 h.p. The primary switch and magnetic starting switches are of the open construction, clapper type. The plungers of the current relays are controlled directly by the starting current and the rate at which the motor is accelerated can be adjusted by varying the spring tension on the relay plungers. The secondary starting resistance is of the cast metal grid type having ample capacity for starting the motor intermittently under load conditions. Where used in connection with motors operating on compression or open tank systems, the motors can be started and stopped automatically by means of pressure regulation or float switches. A parallel line of controllers has also been standardized for use with motors driving centrifugal pumps and machines of similar load characteristics.

New Companies

Letters patent have been issued to the Canada Sign System (Electric) Limited. One of the purposes is stated to be "to acquire, undertake or take over the whole or any part of the business, property and liabilities of the Holman Electric Sign Company."

The Rock Lakes Water & Power Company, Limited, has been incorporated with head office in the town of Fort George, B.C.

The Mirror Lake Electric Light Company, Limited, has been incorporated, the head office of the company being situated at Mirror Lake, B.C.

Flooring for Industrial Plants.

The modern industrial establishment, with its complex machinery, elaborate factory systems and skilled operatives, offers a noteworthy example of evolution from crude and inefficient methods. Not only have mechanical devices been developed to a high state of perfection in the past few decades in order to keep pace with competition, but changes of equal importance have been wrought in the construction of factory buildings, with the object of contributing to the safety, comfort and efficiency of the operatives. Among those details which have received the attention of experts is the subject of flooring.

The problem of flooring the factory is a difficult one, but the obstacles which present themselves in the average plant are claimed to have been overcome by a flooring material known as J-M Mastic, manufactured by the H. W. Johns-Manville Company and described by them as follows:—J-M Mastic flooring provides a surface that is water proof and at the same time practically wear-proof under ordinary service condition. It is also unaffected by acids, alkali and brine. Being waterproof it is absolutely sanitary, as it can be quickly and thoroughly cleaned by the simple process of flushing after which it dries out immediately. It will not originate dust, a point of vital importance in establishments where it is imperative to keep machinery and goods free from dust. The base of this flooring is asphalt mastic, a product in which a finely graded mineral aggregate is bonded together by an asphaltic cement or binder. The mineral aggregate in the material, as made up, will pass through a wire screen ranging from 80 to 200 mesh in fineness.

This flooring can be made in any consistency between extreme hardness and softness and, while always dense, possesses a certain amount of resiliency. It does not cause footsoreness and fatigue like concrete and other non-yielding floor surfaces, and adds greatly to the efficiency as well as to the comfort of employees in machine shops, factories and other industries, who are compelled to stand while at work. Furthermore, being damp-proof, it is an efficient protection against ailments common to damp conditions. It can be laid over any foundation which is firm and stable, and may be applied over wood, brick, concrete or tile already in place. In new construction, concrete or heavy mill construction is the most desirable. This flooring is also easily repaired if changes in the floor surface are made necessary at any time. It adds very little to the dead load, as the standard thickness of 1½ inches weighs only 18 lbs. to the square foot in place. This thickness is sufficient for ordinary trucking requirements but can be varied to meet conditions, ranging from 1-inch for lavatories where the requirements are very light, to 3 inches in thickness for loading docks where the requirements are correspondingly severe.

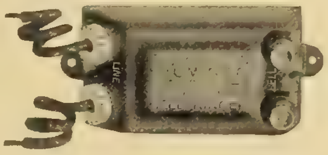
J-M Mastic flooring is perfectly adapted for breweries, canning factories, candy factories, cold storage plants, dairies, dye houses, laboratories, machine shops, packing plants, railroad stations, school houses, institutions, etc. In fact, its scope is almost without limit. It is superior to wood, concrete, brick, tile, slate or composition floors, and may be substituted for floors of those materials to excellent advantage.

Standardizing Their Fittings.

The H. T. Paiste Company have recently made some important changes in their pipe taplet line so as to further standardize these economical conduit fittings. In order to minimize the amount of stock required by dealers, through greater interchangeability of material, certain changes have been made in the sizes of wiring openings so that now 3 sizes of pipe taplet covers are all that are required for sizes of pipe taplets. That is to say the first size of fittings and covers fits all ½ in. and ¾ in. pipe taplets; the second size fits all 1 in. and 1¼ in. pipe taplets, and the third size all 1½ in. and 2 in. pipe taplets; this means that the stock of necessary covers and fittings may be practically reduced by half. These changes do not affect in any way the size and design of the opening in the ½ in. and ¾ in. sizes and these still fit the standard fielding receptacles and rosettes which have been used for years in wooden molding wiring. With this combination of ½ in. and ¾ in. pipe taplets and fieldings the most flexible and economical forms of either lamp or cord outlets are secured.

Bell Ringing Transformer

The Thordarson Electric Manufacturing Company, Chicago, have constantly sought to improve their electrical specialties, which is nowhere better exemplified than in their latest model New Junior bell ringer. This is a superior, low-priced, highly-efficient bell ringer, suitable for residence door bells, buzzers and all classes of light signal work. The new model has the same output and capacity as the previous Junior bell ringer, but it is much smaller and neater in appearance and lower in cost.



The initial investment is the only expense attached to the installation of a bell ringing transformer. It will last indefinitely. The Junior type consumes less than one watt, and for this reason, it is claimed, will not register on the ordinary wattmeter. The manufacturers claim for this bell ringing transformer that it will do more work than any battery and do it better. It may be used for residences, apartment buildings, hotels, office buildings, stores or factories where alternating current is employed.

The P. & S. Keyless Socket.

We illustrate herewith the Pass & Seymour keyless socket embodying the interchangeable feature, the shade holder grooving permitting its use with shade holders. The socket is complete with ⅜ in. aluminium cap. This is a socket which will stand a lot of hard wear, and exposure to fumes and gases.

Northern Electric Dinner.

The second annual general department dinner of the Northern Electric & Manufacturing Company was held on Saturday evening, April 5, in St. Lawrence Hall, Montreal. Nearly 200 employees of the company were present. Mr. A. M. Ritchie, chief of the production department, was chairman, and at the head table were Mr. P. F. Sise, managing director of the company, Mr. N. E. Newton, shop superintendent, Mr. M. K. Pike, distributing department manager, Mr. E. H. McLea, chief engineer, Mr. H. D. Browne, general purchasing agent, Mr. F. D. Donnelly, installation superintendent, Mr. J. S. Cameron, factory engineer, and Mr. W. H. Davidson, general foreman. The toast to the company was proposed by Mr. Ritchie and responded to by Mr. Sise, who outlined the remarkable growth of the company's business between the years 1902 and 1913. Mr. Sise expressed himself as greatly pleased at the good fellowship and co-operation evident at this gathering and expressed the hope that the event would remain an annual one. Other speakers included Mr. Pike, Mr. Newton and Mr. McLea.

Steinberger Wins Again

An appeal from an award of priority in the patent office interference case regarding the invention of a disc strain insulator between Louis Steinberger and Edward M. Hewlett, formerly decided in favor of Steinberger, has resulted in a confirmation of the original finding. The recent decision was handed down April 7th, by the Court of Appeal of the District of Columbia, the former decision being confirmed in all points.

The Royal Rotary

A suction cleaner built on the turbine principle, is described in a little booklet issued by Jno. White, St. John, N.B., who manufactures the Royal cleaners. The working and wearing parts of The Royal consist simply of the motor with turbine attached. The motor is of 1/8 h.p. Robbins & Myers type. The cleaner is equipped with a sight glass for observing the workings of the machine.

A new Standard price list on "Sterling" new code rubber-covered wire has been issued by the Standard Underground Cable Company of Canada, Limited, Hamilton, Ont. The price list is in convenient and durable booklet form printed in two colors and gives prices on their "Sterling" wire for bases ranging from 13 to 20 cents for solid and stranded wire of all commercial sizes. Appended are explanatory notes and a list of electric wires and cables and cable accessories manufactured by this company.

The rejuvenation of the Sons of Jove proposed to be held in Montreal on April 19th has been postponed. The degree team had their first rehearsal on the 15th of April, the team being composed as follows: R. H. Balfour, Jupiter; R. J. Hiller, Neptune; A. Dwight Smith, Vulcan; T. R. Campbell, Pluto; W. D. Black, Mars; C. Duncan, Mercury; F. J. Parsons, Apollo; F. W. King, Hercules; C. M. Tate, Avrenim; Imps, Messrs. J. E. Ryan, G. G. McDonald, T. H. Brennan, J. A. Crowhurst; Sergeant-at-arms, D. H. Ross.

The club of the Montreal Jovians at Cooper's Restaurant will have two classes of membership—resident and non-resident. For the former the fee will be $5 until June and $10 afterwards; for non-residents $5 will be charged. The entire flat at the top of the restaurant is now being prepared, and the club promises to be very comfortable. There will be a large dining and lounge room, and in addition to the usual accommodation, a room in which committee meetings or private dinners can be held. The Executive Committee have made an offer to the Montreal Electrical Society for the latter to make the club their headquarters for meetings, the idea being to concentrate the electrical interests of the city.

Trade Publications.

Scaife Tanks—The W. B. Scaife & Sons Company, Pittsburgh, have just issued their new catalogue of gasoline storage outfits, gasoline tanks, garage tanks, pumps, etc. These outfits and tanks are suitable not only for gasoline but for oils and other liquids. The catalogue illustrates a number of simple methods of installing these tanks so that they may be well out of the way.

Pneumatic Tools—Bulletins 137, 138 and 139, describing Chicago Giant Rock Drill and appurtenances. Issued by the Chicago Pneumatic Tool Company.

Mazda Lamps—Bulletin 11A issued by the Engineering Department of the National Electric Light Association, descriptive of Mazda 60 candle power street series lamps.

Steel Unilets—The Appleton Electric Company of Chicago have issued a neat booklet in which is fully described and listed the complete line of rectangular steel unilets manufactured by this company.

High Tension Switches—Bulletin No. 5 issued by the Delta-Star Electric Company of 617 West Jackson Blvd., Chicago, descriptive of their high tension type M.B. pole-top switches for controlling loaded circuits.

Frantz Premier—An electric suction cleaner by this name is described in a little booklet just issued by the Premier Vacuum Cleaner Company of Cleveland. This firm is represented in Canada by Messrs. Calvert & Dwyer, 117 Wellington street west, Toronto.

High Tension Switches—Bulletin No. 5 (copyrighted) issued by the Delta-Star Electric Company, Chicago, is an interesting treatise of high tension switching problems and will be of value to managers selling power from high tension lines. Complete information is given as to the installation of switches on poles, insulation tests, etc., and operating characteristics.

Ventilating Fans—Bulletin No. 151 issued by the Mechanical Appliance Company, Milwaukee, describing Watson motor driven ventilating fans made in sizes from 18 in. to 42 in., for d.c. and a.c. current, single or polyphase. Methods of installation are illustrated and a chart is included for determining the fan capacity required for rooms of various sizes and used for various purposes as moving picture theatres garages, billiard parlors, restaurants, schools, etc.

Automatic Controllers—The Cutler-Hammer Manufacturing Company of Milwaukee have issued Bulletins 9630. 9632, 9640 and 9642, illustrating and describing a new line of automatic controllers for use with slip-ring polyphase motors operating on low and high voltage circuits. New types of magnetic switches are used on these controllers the construction and functions of which are fully described. Bulletins 6090, 6095, 6100 and 6105 describe types of automatic starters for direct current motors, which are used in place of hand starters where it is desired to get proper acceleration regardless of the carelessness of the workman and where convenience of control is essential. These starters can be placed out of the way and the motor started by merely pressing a button or closing a small switch.

New Books

Wiring diagrams of electrical apparatus and installations—The McGraw-Hill Book Company, New York, publishers. Price, $2 net. This volume contains a collection of circuit diagrams representing, more or less completely, all branches of electrical engineering with the exception of telephony and telegraphy. The diagrams have been taken from actual practice and although some are not new, they all represent important principles. The diagrams show much more than simply wiring connections and by their use it will be possible to lay out a modern switchboard to connect up the apparatus and to understand the principles of operation of the various electrical machines. Armature winding is omitted as requiring too much space for proper treatment. This book contains much that will be of interest and value to the engineer, the operator and the repair man.

Current News and Notes

Barrie, Ont.

On April 14, the arrival of Hydro-electric power from the Severn River was celebrated by a banquet. The rates to be charged will be 4c per hundred square feet of floor space, plus 4½c per kw. hour metered. The commercial lighting rate will be 9c per kw. hour for the first 30 hours use of the installed capacity and 4½c per kw.h. for all additional current. The power rates will be 3.6c per kw.h. for the first 50 hours, 2.4c for the second 50 hours and 1.3 for additional. All rates are subject to a 10 per cent. discount. Barrie has contracted for 750 h.p. but present indications are that this amount will be exceeded during the first year's operations. Barrie has been a believer in municipal control of the electrical plant for the last fifteen years, at which time Dr. S. M. Wells, then mayor of the town, was chiefly instrumental in removing the plant from the control of private interests.

Brandon, Man.

Following an address by Utilities Commissioner Robson before the members of the city council and other interested citizens, a resolution was passed favoring the bringing of the municipal operations of the city under the provisions of the Public Utilities Act. It is at the option of the various municipalities whether they come under this act or not, but Commissioner Robson's work in unifying and standardizing a system of operation for Public Utilities has been so successful that the western towns are showing willingness to avail themselves of the opportunity offered by the government.

Breslau, Ont.

This village has made a request for 100 h.p. to be supplied from the Berlin sub-station. Arrangements are being made for the supply which will also reach Elmira.

Calgary, Alta.

The Northern Electric & Manufacturing Company have been awarded the contract for the installation of a police signal system.

Chicoutimi, P.Q.

La Compagnie des Eaux et de l'Electricite de Chicoutimi, are installing a 1,500 kw. Westinghouse 60 cycle, 3-phase, 2200 volt generator, two 300 kw. 2200/575 volt motor-generators and a 125 kw. exciter. These machines are to replace a 200 kw. 2-phase, 133 cycle unit, a 200 kw. 2-phase, 60 cycle unit and a 200 kw., 575 volt d.c. unit. The new generating equipment will go into service about the first of June. Mr. H. R. Kimball is resident engineer on the construction work.

Dryden, Ont.

A by-law is being submitted authorizing the issue of debentures to the amount of $6,000 to purchase the electric light distribution system of the Dryden Timber & Power Company. Power for operating this system will still be purchased from this company.

Fernie, B.C.

On April 4, a by-law was carried to raise the sum of $10,000 for the purpose of extending the electric light system.

Fort William, Ont.

Four new cars have been shipped by the Ottawa Car Company, and orders have been placed for a number more for summer delivery.

The report of the Water, Light & Telephone Department for the year 1912 recently issued by Mr. A. L. Farquharson, Manager of Utilities, shows that both the light and telephone departments have been operated this year at a profit. The telephone net surplus for the year is $4,025 as against a deficit for the previous year of $2,728. In the lighting department the net surplus for the past year is $21,085, which also is an increase over the surplus of last year of some $8,000. The Waterworks Department shows a loss of $12,928 on the year's operations:

Gananoque, Ont.

It is said the Gananoque Electric Light Company contemplate a transmission line to connect this line and Kingston.

At a recent meeting of the council it was unanimously decided to accept the offer of the Gananoque Electric Light Company for the supply of electric energy and to sign a contract for ten years.

Granby, P.Q.

It is reported that at the next meeting of the provincial legislature the C. P. R. company will apply for a charter to build an electric railway line connecting Farnham with Granby.

Halifax, N.S.

An offer has been received by the city to lease the Halifax Electric Tramway System for a term of years in the event of this road being taken over by the city.

The railway committee of the legislature having recommended that the public ownership bill of the city council be thrown out, the city council are said to have decided to oppose every bill that may be brought forward by Mr. Robert and his associates.

The Halifax Electric Tramway Company, who are planning to develop a water power on the Gaspereaux River, offer, if the city accept their proposition and drop the municipal ownership agitation, to reduce the cost of power and light to an appreciable extent. The price for light is to be reduced from 15 to 10c per kw.h. with liberal discounts. The price of power will be 5c per kw.h. instead of 10c as at present, this offer also carrying liberal discounts. The company in presenting their case figure that their offer means a saving of $76,000 per year to the people of Halifax.

Iroquois Falls, Ont.

It is said to be the intention of the Abitibi Pulp & Paper Mill Company to build a line between here and Kettle Falls to transmit power for their own use, as well as for the town of Cochrane, any mills along the line and the Elexe Nickel Mine at Iroquois Falls.

Kingston, Ont.

It is said that tenders are to be called for conduits to be laid in about seven blocks so that all wires can be placed underground.

Langham, Sask.

A by-law was recently passed to expend $12,000 on the installation of a lighting plant. The British Canadian Engineering & Supply Company have been awarded the contract and the equipment will consist of a Ruston suction gas engine and producer plant coupled to a suitable generator.

Lawrencetown, N.S.

The ratepayers have carried a by-law in favor of installation of a small electric light plant. A 40 h.p. dynamo will be operated by a steam engine now in the town mill. Poles, wire, dynamo, etc., required.

Linden, N.S.

It is reported that an electric plant will be installed at this point in the near future. The interests reported to be behind the proposition have coal mines in the district, which will enable them to operate the plant at a comparatively low cost.

Montreal, Que.

During the present month 1,000 men will be engaged on the addition to the power plant of the Laurentide Company, Grand'Mere, P.Q. During the winter great progress was made with work on the cofferdams, and when the plant is installed next year about 70,000 horse power will be available, much of which will be sold.

An issue of 5 per cent. first mortgage bonds will be made by the Montreal Public Service Corporation.

The Montreal Tramways Company will install at their William street power house a 1500 kw. motor generator set manufactured by the Canadian Westinghouse Company. The power line will be furnished by the Canadian Light & Power Company.

On retiring from the position of chief electrical inspector of the Canadian Fire Underwriters' Association, Montreal, Mr. James Bennett was presented with a diamond watch charm. The presentation was made by Mr. C. M. Tate, who has succeeded Mr. Bennett, on behalf of the staff in Montreal, Quebec and Sherbrooke. The charm is engraved "31-3-13.—A token of esteem from the staff to Mr. J. Bennett, chief electrical inspector—C.F.U.A." Mr. Bennett made a suitable reply, expressing appreciation of the gift.

The Quebec Railway, Light & Power Company have made a cut from 15c to 7c per kw.h. for private lighting, and the Dorchester Electric Company announce their intention of cutting the price to 6c.

The Quebec Public Utilities Commission have held a further enquiry into electrical conditions in the city of Quebec, at which the Canadian Fire Underwriters' Association were represented by Mr. James Bennett. After a brief hearing the Quebec Railway, Light and Power and the Dorchester Electric Companies were ordered to ground all the transformer secondaries or neutrals on their system. As Mr. Bennett recommended that the grounding be made to the water piping system of the city, the commission instructed the companies to approach the Quebec City Council and endeavor to secure permission to comply with this recommendation, and to report back to the commission the result of their negotiations at a special meeting to be held on the 29th of April at Quebec.

Marysville, N.B.

A movement is under way to secure a street lighting system.

Norwich, Ont.

Mr. H. Webster, owner and formerly manager of the electric light plant, is now offering his equipment for sale, including a 65 h.p. steam engine, transformer equipment, meters, real estate, etc.

Ottawa, Ont.

Action is being renewed to have the overhead telegraph, telephone and light and power wires put underground on the main streets.

Owen Sound, Ont.

The Hydro-electric Power Commission of Ontario have quoted this town a rate of $31 per h.p. for 800 h.p. It is stated that this rate is considered by the citizens as very favorable and likely to be accepted.

Penticton, B.C.

On Thursday, April 3, before a representative gathering of citizens, the new electric light system at Penticton was successfully put in operation. The plant consists of a 200-horse power Diesel oil engine driving a 100-kilowatt dynamo, and it is calculated to supply sufficient power to fill the requirements of the municipality for two years, when it is contemplated to install another unit of equal capacity, provision for which has been made in the new power house.

Pembroke, Ont.

The Town Council contemplate a fire alarm system.

Port Arthur, Ont.

Tenders have been called for a wireless telegraph station, $5,000.

It is reported that the C. N. R. Co. will install a power plant at Lake Helen, near Nipigon, the material being already on the way.

At the end of the present year the joint commission system of operating the Port Arthur and Fort William electric railway will be discontinued and each city will, after that date, operate its own line.

Portsmouth, Ont.

The new street lights were turned on for the first time on April 15th. The system used for turning the lights on and off is that of a time clock.

Peterborough, Ont.

The local legislature have granted the city the right to buy out or expropriate the plant of the Peterborough Light & Power Company. The question as to whether this company has the right to continue in the lighting business as a competitor of the municipality has not yet been determined, and will probably be a matter for the courts to decide.

Regina, Sask.

At a recent discussion of the cheap power question with reference to the use of coal fields in the vicinity, it was stated that power could be produced at 1.53c per kw. hour and a rate of $21.65 could be given manufacturers using more than 100 h.p. It was stated that the consumption of power in Regina had increased from 1,200,000 kw. hours in 1909 to 3,750,000 kw. hours in 1912. The consumption of Moose Jaw, through which the line connecting the mines with Regina would run, was 2,500,000 kw. hours in 1912.

Sackville, N.B.

An electric plant to cost $70,000 is being discussed.

Saskatoon, Sask.

Tenders were received by City Commissioners till April 24 for double tracking certain streets.

The total receipts for the month of March of the Saskatoon Street Railway system were $14,682, an increase of $4,177 over the previous month. This is sufficient to take care of the total expenses for the month and leave a margin of $270. The gross income from the light and power departments for the month of March was $33,080.

Sebringville, Ont.

Lighting and general equipment is to be purchased for the new extension to Sebringville.

Sherbrooke, Que.

The Sherbrooke Railway & Power Company has just completed a new contract for 500 h.p. to be delivered to a new industry about to start operations in Sherbrooke.

Silverton, B.C.

Recent advices from Silverton, B.C., state that several of the leading citizens are negotiating with the New Denver Electric Light Company for the construction of a power line to Silverton and the supply of electric current for lighting purposes throughout the district.

St. Catharines, Ont.

The city council has received an offer from the Lincoln Light & Power Company to supply private consumers at a

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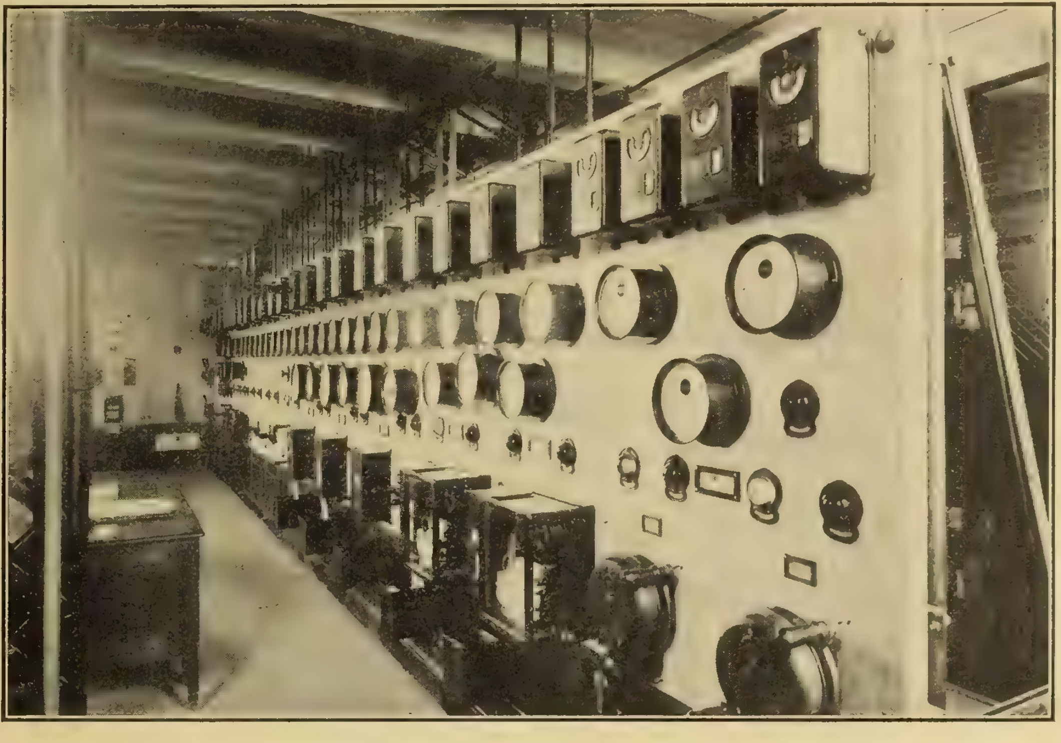

Siemens 18 Panel 22000/2200/600 Volt Switchboard supplied and installed by us for the city of Port Arthur

We supplied the complete sub-station equipment, consisting of 7-750 K.V.A., 22,000 volt transformers, switchboard shown above, lightning arresters and 2-750 H.P. motors generators.

Half the foregoing was a repeat order after our apparatus had been in satisfactory operation for 18 months.

We undertake the complete equipment of electrical plants of every description up to and including 110,000 volts.

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rate of 5.6c per kw. hour with 10 per cent. discount. They also agree to abolish meter rates and to reduce the monthly minimum charge to 75c.

Strassburg, Sask.

A by-law was passed on April 14, authorizing an expenditure of $12,000 to cover the cost of an electric light system.

Toronto, Ont.

The Hon. Adam Beck has introduced a bill which will compel all contracts between a municipality and private companies to be submitted to a vote of the ratepayers. This places these contracts on the same footing as contracts with the Hydro-electric Power Commission.

A bill has been introduced in the Provincial House, giving the city of Toronto power to purchase the Toronto street railway and the Toronto Electric Light Company's system. The price mentioned is 160 for the Toronto Railway stock and 135 for the T. E. L. stock, in addition to assuming the bonds in each case.

A bill has been introduced by the Hon. Adam Beck, providing for a network of electric railways through the province of Ontario. Such roads may be constructed by the municipalities themselves, or the work may be undertaken by the Hydro-electric Power Commission. The cost of the railways must be borne by the municipalities concerned. Wherever possible the railways would be built along the right-of-way of the provincial transmission lines.

Following the removal of Mr. W. R. Sweany, acting general manager of the Toronto Hydro-electric system, from office, the Commission has announced the appointment of Mr. Couzens as general manager. Mr. Couzens was, until recently, general manager and electrical engineer of the Corporation of Hempstead, London, Eng., and is said to have had wide experience in both engineering and managerial work. In the interval the operation of the system is being looked after by Mr. R. A. Ross, the consulting engineer of the commission, and Mr. R. G. Black, for many years electrical engineer of the Toronto Electric Light Co.

Direct telegraph communication was recently established between London, Eng., and Victoria, B.C., through the application of a valuable invention of Mr. John Gott, chief electrician of the Mackay Companies.

The Toronto & York Radial Railway Company and the city of Toronto have at last come to an agreement whereby the company agrees to double track its line on Yonge street between Woodlawn avenue and the northern city limits, a distance of approximately four miles. The railway company is also allowed to equip and maintain the extensions and branches between and to connect the present Toronto terminals of the Scarboro, Metropolitan and Mimico divisions. The company is also given the right to operate Sunday cars on the Metropolitan division and to increase their bond issue per mile from $20,000 to $30,000.

Work has begun on the Danforth avenue civic car lines.

In the provincial estimates recently brought down by the government, $2,500,000 is set aside for extensions to the Hydro-electric Power Commission's system. This will include a $150,000 office building.

Plans have been filed by the Toronto and Suburban Railway Company for the entrance of their Woodbridge line into the city, the plans covering the six miles between Davenport Station and Weston.

The Ontario Railway & Municipal Board has made an order fixing the sum the city must pay to the Toronto & York Radial Railway Company in taking over the Humber section of the Mimico line. The amount named is $79,245.

The Electrical Maintenance & Repairs Company, 162 Adelaide street west, Toronto, announce that owing to the large increase in their business they have recently found it necessary to double their factory and office space and have also added the latest facilities for handling heavy work.

The Masco Company, Limited, formerly of 205 Yonge street, Toronto, have moved to more commodious quarters at 58 and 60 Church street.

Valleyfield, Que.

Fire engine and alarm system will be purchased, it is said.

Vancouver, B.C.

Another record was established by the British Columbia Electric Railway Company at Victoria during the first three months of the present year, when the passengers carried on the city and suburban lines of the company aggregated in number 3,099,098, compared with 2,429,659 for the corresponding period in 1912; an increase of 28 per cent.

The Mirror Lake Electric Light Company of Mirror Lake, B.C., recently made application to the provincial authorities for a license to take and use 100 miners' inches of water out of Bjerkness Creek, which empties into Kootenay Lake near Mirror Lake. The water will be diverted about 1,500 feet from the mouth of the creek above the falls, and will be used for power and light purposes in the adjacent district.

The Canadian Pacific Railway Company will excavate a tunnel through the Selkirk Mountains at the point now known as the Rogers Pass. The tunnel will be 5.2 miles in length and at one point is 540 feet below the surface. It is practically certain that electric drive will be installed through the tunnel. Later advices also state that the C. P. R. have decided upon a second tunnel through the famous Kicking Horse Pass of the Rockies. This tunnel will be sixteen miles long, the longest in the world. The eastern end of the tunnel would be in Alberta and the western end in British Columbia. Doubtless also this tunnel will be electrified.

Wallaceburg, Ont.

The Premier Electric Light & Power Company, Limited, W. R. Waghorne, manager, who are at present operating a 133 cycle, single phase, 120 kw. steam generator, contemplate changing over to gas engine power and generating 3-phase, 60 cycles.

Windsor, Ont.

By an overwhelming vote the citizens of Detroit on April 7, decided in favor of municipal ownership of their street railway system.

Winnipeg, Man.

Tenders received until May 5 for underground conduit material.

Tenders are called to May 8 for six 100 kw. oil-insulated, self-cooled transformers; two 13,000 volt electrolytic lightning arresters and six 100 amp. choke coils, for Beausejour & Stony Mountain sub-stations.

The Fort Garry Hotel, Winnipeg, was recently the recipient of probably the largest single shipment ever sent out from the Amherst Plant of the International Engineering Works, Limited. This hotel, which is being erected by the Grand Trunk Pacific Railway Company is to have a complete power plant furnished by the above company. It will consist of four 300 horse-power Robb-Brady Scotch boilers and three vertical high-speed cross-compound engines with two duplex air compressors, smoke connection for the boilers, and auxiliary apparatus. The boilers weigh 32 tons each, are 10 feet in diameter by 17 feet long, with double furnaces 4 feet in diameter by 14 feet 2 inches long.

Yarmouth, N.S.

An electric fire alarm system is contemplated.

The WESTON SYNCHROSCOPE

Constitutes a very simple and absolute *perfect solution* of problems involved in coupling alternating-current machines in parallel without danger or sensible disturbance of circuit conditions.

The indications are infallible.

There is only one object to observe

The movement of the pointer is smooth and certain; it inspires confidence.

It indicates exact synchronism within 1 deg. of true phase coincidence over a wide range of frequency and voltage.

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Demonstrations of the operative characteristics of these remarkable instruments may be observed in our New York Office and also in the offices of Selling Representatives in Philadelphia, Chicago, San Francisco and Toronto.

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Boston, 176 Federal Street.
Philadelphia, 342 Mint Arcade.
Birmingham, Brown Marx Bldg.

Detroit, 44 Buhl Block.
St. Louis, 915 Olive Street.
Denver, 231 15th Street.
San Francisco, 682 Mission St.
Cleveland, 1729 E. 12th Street.

Toronto, 76 Bay Street.

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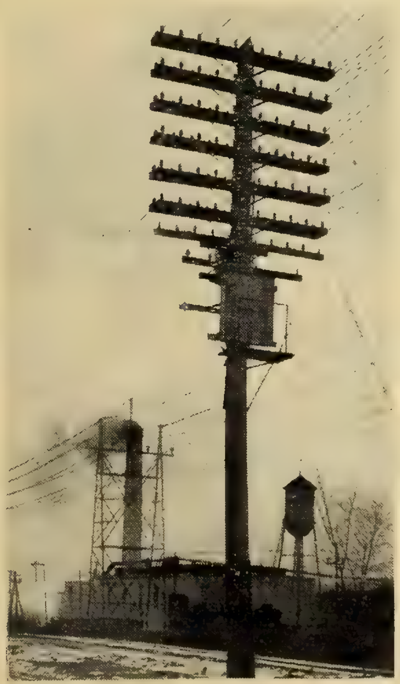
Johannesburg, So. Africa, F. Peabody Rice, Standard Bank Building, Harrison St.

The Steel Company of Canada, Limited



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HALIFAX

FOR SALE

100 H.P. Boiler and Engine, Watrous Engine Co., Brantford, Ont. Dynamo, Allis-Chalmer, Bullock, Montreal. Apply Town Clerk, Milton, Ont. 9-10

FOR SALE

One 50 h.p., 25 cycle, 3-phase, 550 volt C. G. E. induction motor. Complete with pulley base and starting box. Practically new. The Hespeler Furniture Co., Hespeler, Ont. 7-9

FOR SALE

One Westinghouse type C. 100 h.p., 2000 volt, 25 cycle, induction motor, 480 r.p.m., with starting panel complete.

One General Electric type A.M. form B., 2200 volt generator, 32.6 amp., 60 cycle, 900 r.p.m., with exciter and combined generator and exciter panel complete.

First class condition, crated for shipment, Welland, Ont. For particulars apply to Hydro-Electric Power Commission of Ontario, Continental Life Building, Toronto. 9-10

WANTED—A second hand Series Arc Dynamo, about thirty or thirty-five lights, 6.6 amp. Must be in good condition. Could also use a few series inclosed arc lamps. Address Box 19, Aylmer, Ont. 9

Car Ventilating Systems

The Vacuum Car Ventilating Company has commenced manufacturing Mechanical Car Ventilating Systems under Canadian Patent No. 128070, dated September 13, 1910, and is prepared to furnish same on demand. For detailed information and prices, address Lock Box No. 25, Windsor, Ont. 10-t.f.

A large firm manufacturing carbon brushes for all kinds of service desires good electrical or supply firm or else good salesmen to represent them in various parts of Canada. Apply Box 774, Electrical News, Toronto. 9-10

CITY OF REGINA

Sealed tenders, registered and clearly marked on the outside of the envelope, "Tender for Power House Equipment," and addressed to the City Commissioners at Regina, will be received up until noon of **May 15th, 1913**, for the supply of:—

One pair vertical boiler feed pumps; each pump's capacity to be 7,500 imperial gallons per hour.

One combined open heater and meter, capable of handling 125,000 lbs. feed water per hour.

Copies of specifications may be had from Mr. E. W. Bull, Superintendent of Light and Power, Regina, Sask. A marked cheque for five per cent. of the amount of bid must accompany each tender.

The City Commissioners reserve the right to reject any or all tenders. 9-10

Situations Wanted

Electrical Engineering Graduate, four years' experience shop, test, engineering staff, and at present on large distributing system, wants employment in British Columbia or Alberta. Victoria preferred. Box 772, Electrical News, Toronto, Ont. 9

Situations Vacant

WANTED—Operators familiar with A.C. Generators. Box 751, Electrical News, Toronto, Ont. 7-9

WANTED—Man with Engineer's License, as helper in Power House. Steady employment. State experience and salary expected. Box 768, Electrical News, Toronto, Ont. 9-10

Hydro-Electric operator wanted to take charge of eight hour shift, $75.00 a month. Box 777, Electrical News, Toronto, Ont. 9-10

WANTED—Resident Sales Manager to sell Tidman's Reinforced Hollow Concrete Poles and Provincial Rights; calling only on Steam and Electric Railways, Telegraph, Telephone, Gas and Power Lines, States, Counties and Cities for ornamental purposes. No competition. Endorsement of high class engineers. No experience needed. To result getters income very large. Permanent future. State what territory and submit references. 941 Monadnock Bldg., San Francisco, California. 9

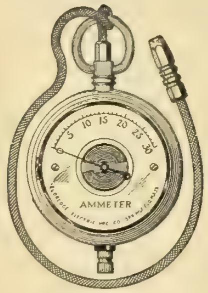
For Rent—Cottages

If you want a real holiday, plan to spend your vacation this year in Muskoka where "the breezy call of incense breathing morn" will put new life in mind and body. Muskoka offers more real healthful enjoyment for less money than any other resort in the world.

Four cottages to rent $125 to $200 on Bohemia Island, less than a mile from Royal Muskoka Hotel and good Golf Links. Box 771,

Electrical News, Toronto Ont.

Pocket Battery Ammeters



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A few dollars spent in advertising your proposals in

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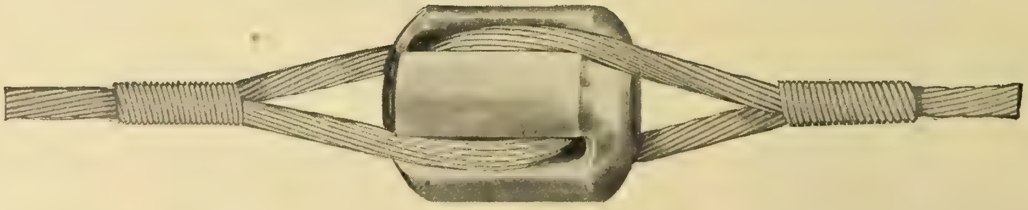

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For Satisfying Results in Underground Subway and Power House Construction specify American Bitumized Fiber Conduit Strongest and most durable conduit made.

Electrolysis proof—water-proof—gas proof

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Efficiency in Semi-Indirect Lighting

depends very largely on the glassware. If the ***glass*** is right the ***light*** will be right in most cases. That's why

Delica White Glass

is the proper material for semi-indirect bowls. There are no imperfections in this pure white glass. All shadows are absolutely eliminated. And its diffusing properties are remarkable.

¶ You should investigate it now. It is selling very fast. Shall we bring photos?

The Pittsburgh Lamp, Brass & Glass Co., of Canada, Ltd.

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Special Representative

Our Telephones and Apparatus are Par-Excellent

Are Made for Good, Hard, Honest Service

They have withstood the **real test—Years of exacting service.** Our **Telephones represent the last word** in design and construction and are strong, durable and attractive. Furnished in all popular finishes.

Get our prices on Switchboards, Series Telephones, Bridging Telephones, Desk Telephones, Extension Bells, Magneto Bells, Transmitters, Receivers, Induction Coils, Condensers, Magnetos, Batteries, Plugs, Jacks, Drops, Lamps, and all kinds of Telephone, Switchboard and Exchange Equipment, including the most efficient protective apparatus on the market.

LET US KNOW YOUR REQUIREMENTS

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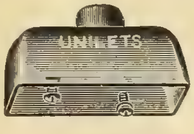
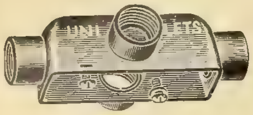
LAFAYETTE, INDIANA, U. S. A.

DRAWN STEEL **"UNILETS"**


Type No. 0

Type No. 2


Type No. 4

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Rectangular Steel Unilets for ½-in. to 3-in. Conduit Inclusive

Successful Contractors are those using up-to-date fittings

UNILETS

are the ideal fittings for up-to-the-minute work and for neatness in appearance and durability they cannot be surpassed. Catalog No. 6 and Booklet sent upon request. May we send you copies?

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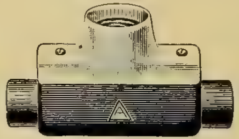
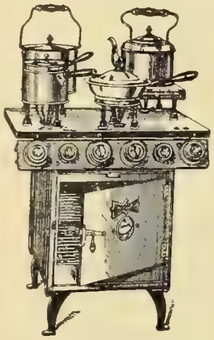

Type No. 2 with Appleton No. 7650 Receptacle attached

Type No. 2 with P. & S. No. 577 Receptacle attached

Type No. 2 with Hubbell No. 5418 Receptacle attached



More Simplex Electric ranges, Electric irons, etc. will be used this year than ever before.
You want to sell your proportionate share. Educate your customers early in Simplex goods before motor trips and other outdoor "distractions" make them harder to interest.
You want enough Simplex appliances to make an impressive display.

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OUR MOTTO IS : — **"Rapid, Reliable, Repairs"**

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Yours etc., etc.
The Electrical Repair Co.

Phone : Adelaide 3183, Day
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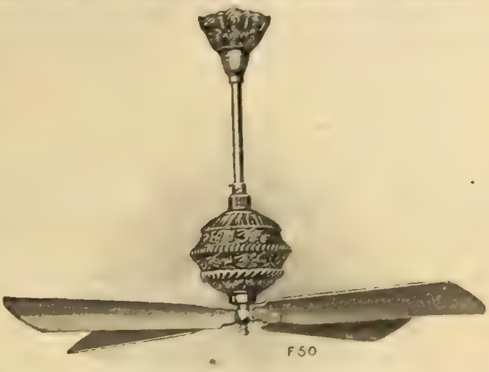
"This Summer I'm Going to Have a STANDARD Fan!"

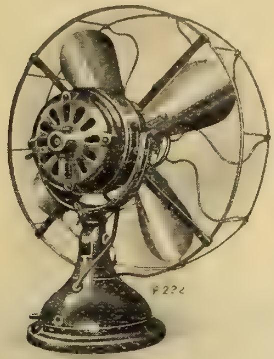
Dozens of women in your community who have enjoyed the comfort of "STANDARD" Fans in the homes of their neighbors—who have read the convincing "STANDARD" advertising in the magazines have made up their minds to own "STANDARD" Fans this season. The harvest is ready for your reaping, if you handle "STANDARD" Fans.



Direct Current Style "B"

Robbins & Myers "STANDARD" Fans

Direct and Alternating Current



Model 14 Alternating Current

We are arranging for representation now in open territory. Our first attention-compelling advertisement to Fan users is scheduled to appear in the Saturday Evening Post, May 3rd. Other strong advertisements will appear throughout the selling season.

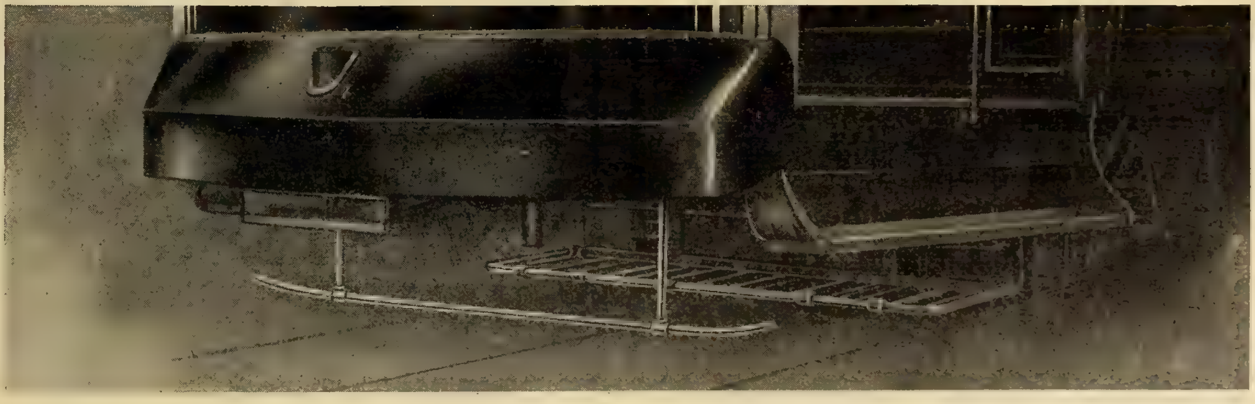
They will have the usual result—a rush for "STANDARD" Fans when the first hot days arrive. The time is short! Write to-day for full details about our dealers' proposition.

The Robbins & Myers Co., Springfield, Ohio

We also manufacture small motors, both D.C. and A.C., for all purposes.

The Parmenter Automatic Wheel Guard

FOR STREET CARS



Arrangements for the manufacture of these wheel guards have been made with the Schofield-Holden Machine Co., Ltd., Toronto, Canada, under Canadian Patent No. 131,381 Dated Feb. 28, 1911 and can be seen in operation at their factory 2 Carlaw Ave., Toronto.

These wheel guards are attached to the truck of the car and are absolutely automatic, always follow the rail whether on curve or straight track.

For Full Particulars Address

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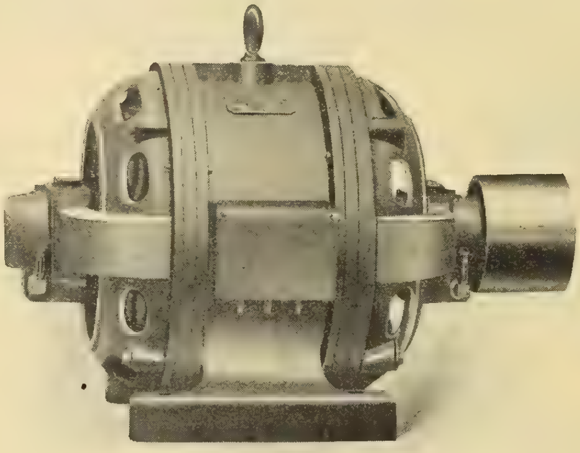
"Union" Motors
for all
Industrial Purposes



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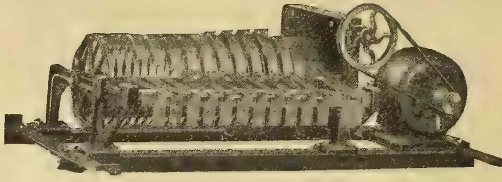

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No. 1123 Broadway, **New York.** No. 617-631 W. Jackson Blvd., **CHICAGO**

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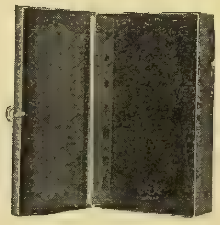
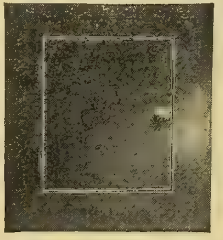
—prompt shipment from stock in standard sizes and styles at lower prices than you have been paying.

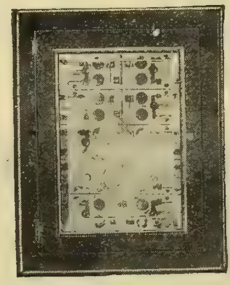


Type A—The usual box dust tight cover

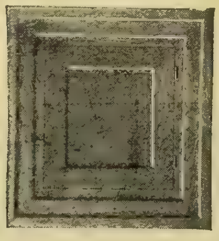


Type P—A medium price box with a door and trim

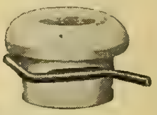
Type C—A high-class one, beaded and paneled



Type G. With a beveled plate glass panel in door.



Type SW. Steel, with natural oak, mahogany or walnut finish.



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We can furnish any quality of arms, pins, brackets, or pole line hardware you call for if you can wait for factory shipment, but stock only which carries our guarantee.

Superior

This includes: Washington Fir not less than 85% heart, Georgia Pine—Long Leaf—not less than 75% heart Kyanized—Spruce. Pins and Line Hardware—A T and T specifications.

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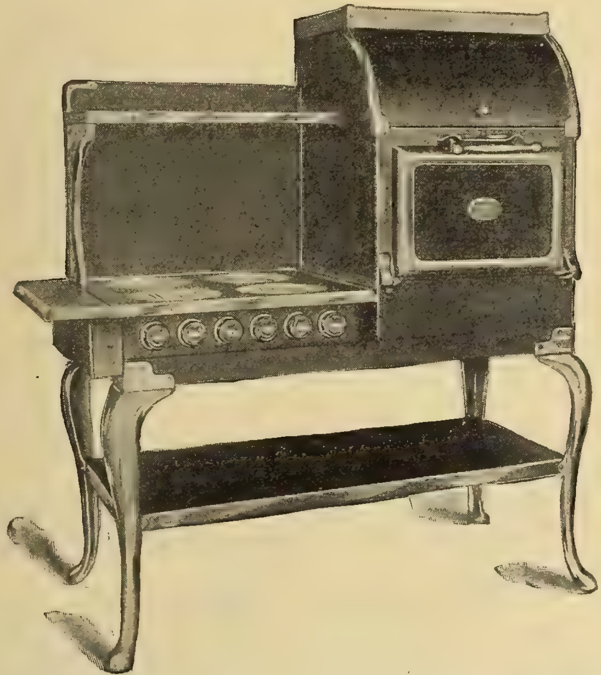

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The 1913 models are now ready and contain many valuable improvements, including our new and perfected heating units.

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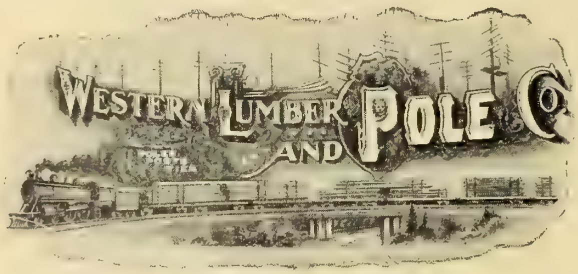
Menominee, Mich.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For prices on B. C. Cedar Poles address

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must be right—no culls, no doubtful ones. Our British Columbia poles are without an equal and we can ship them

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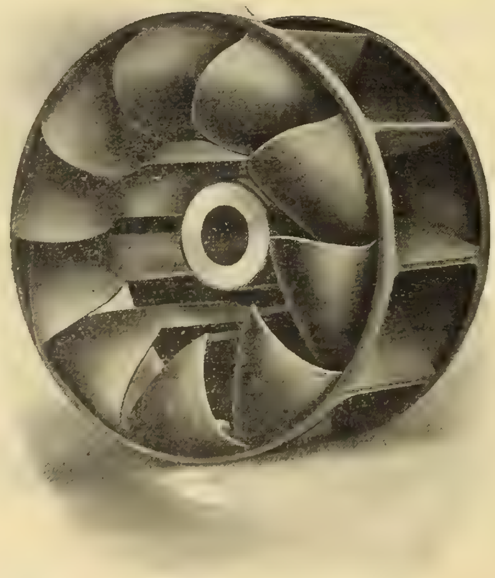

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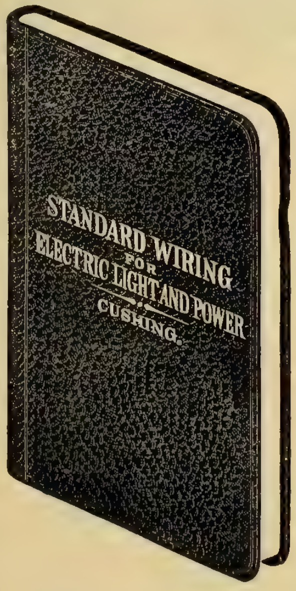

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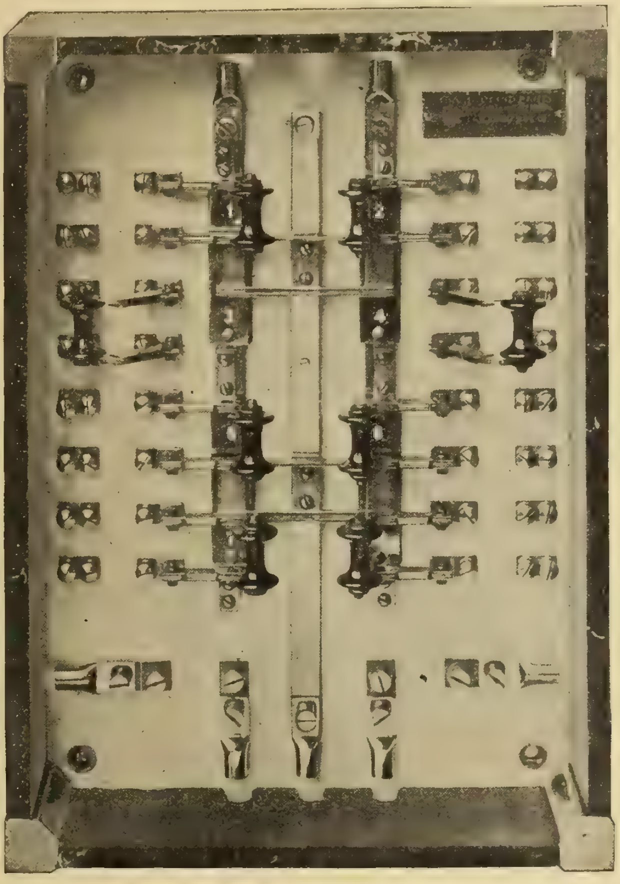

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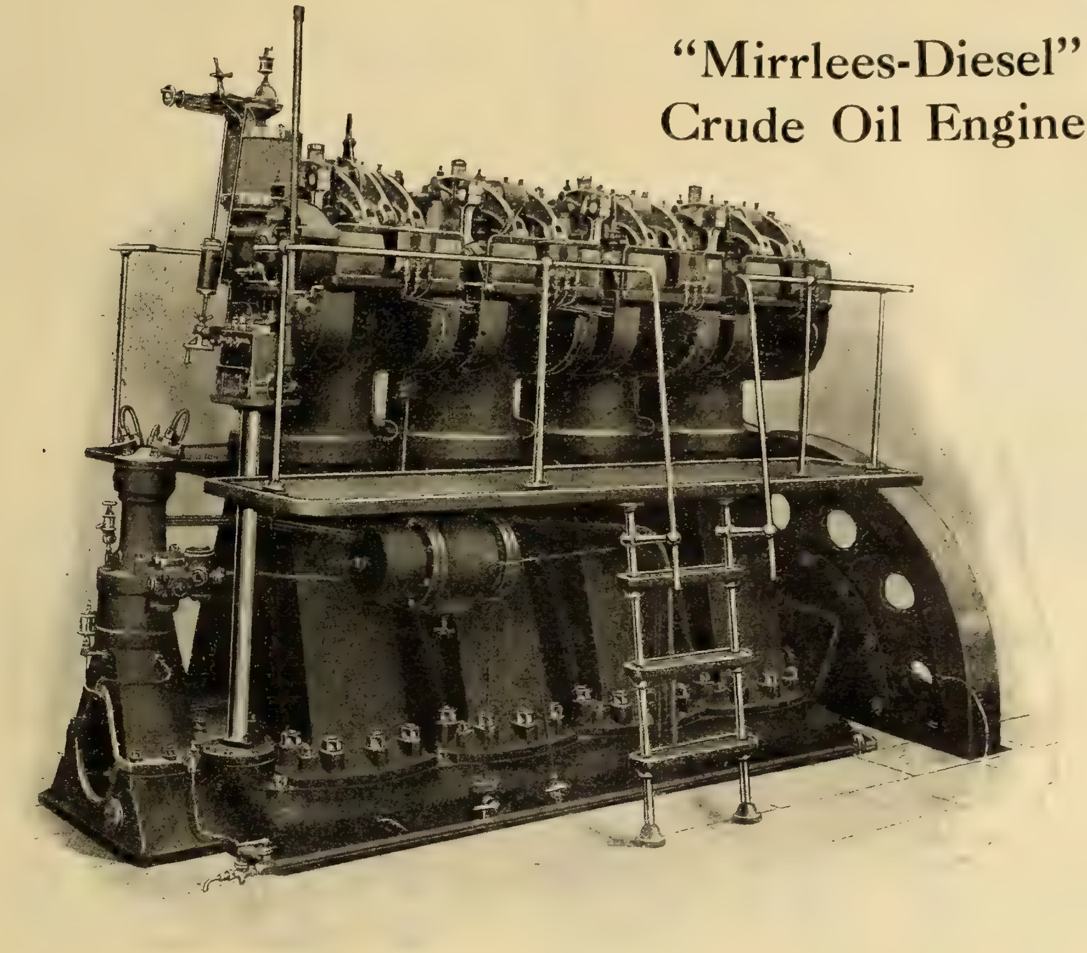

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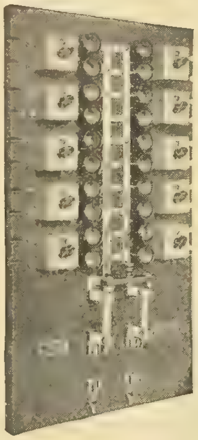

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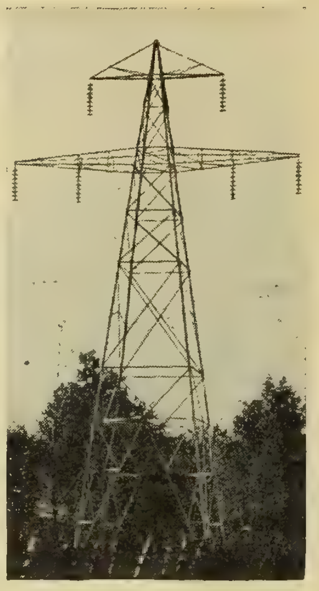

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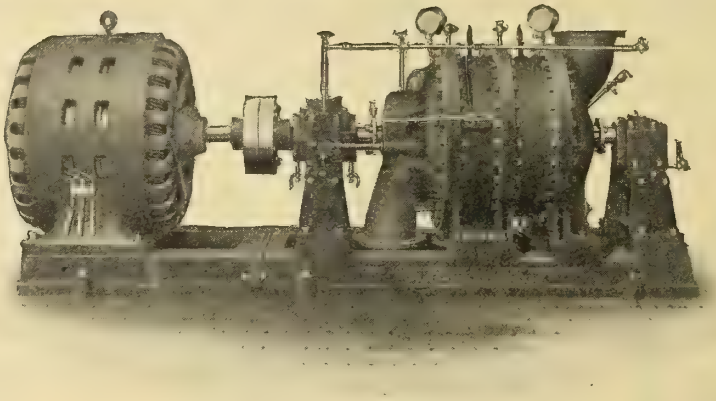
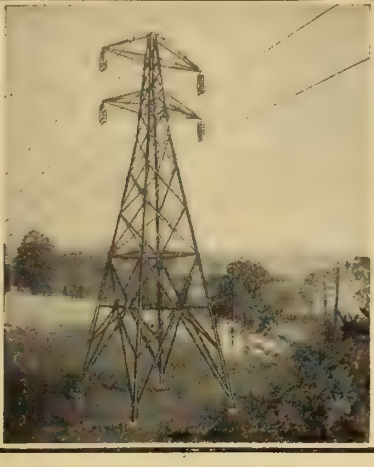
Structural Steel of all kinds

TURBINE PUMPS



"RELIABILITY" is the strongest feature of "INGLIS" Steam and Motor Driven Pumps.
They are guaranteed to give reliable and satisfactory service.
Write us for particulars.

The John Inglis Company, Limited Engineers and Boiler makers
14 Strachan Avenue, TORONTO, CANADA



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Galvanized and Painted
STEEL STRUCTURES of every description
Founded 1802
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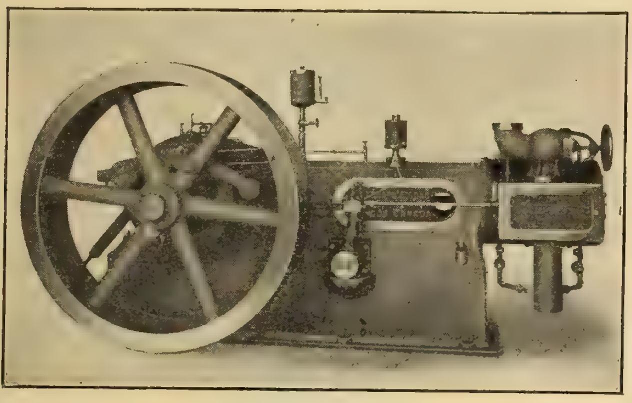
New York Office, 26 Cortlandt St. PITTSBURGH, PA.



Engines of All Types
for
Electrical Service
BOILERS — HEATERS — PUMPS
TANKS AND STACKS
E. Leonard & Sons, London, Can.
AGENCIES: St. John, N.B. Montreal Toronto
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Special Prices
on Electrical Books

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The Steam Turbine, by Robert M. Neilson. Published in 1903 by Longmans, Green & Co., 294 pages, illustrated. Price $1.00.

Telegraphy, bp Sir W. H. Preece, K.C.B., and Sir J. Sivewright, M.A. Published in 1905 by Longmans, Green & Co., 504 pages. Price $1.00.

Electro-Dynamos, by Charles Ashley Carus-Wilson. Published in 1898 by Longmans, Green & Company. 298 pages, Price 50c.

Elementary Lessons in Electricity and Magnetism, by Silvanus P. Thompson. Published in 1895 by MacMillan & Company, 628 pages, illustrated. Price 50c.

Electric Lighting & Heating, by Sydney F. Walker, Published in 1907 by Norman W. Henley Publishing Company. 438 pages, illustrated. Price $1.00.

Dynamo-Electric Machinery, by Francis B. Crocker, E.M., Ph.D. Published in 1908 by American School of Correspondence. 236 pages, illustrated. Price $1.00.

Telephone Law, by A. H. McMillan. Published in 1908 by McGraw Publishing Company. 332 pages. Price $1.50.

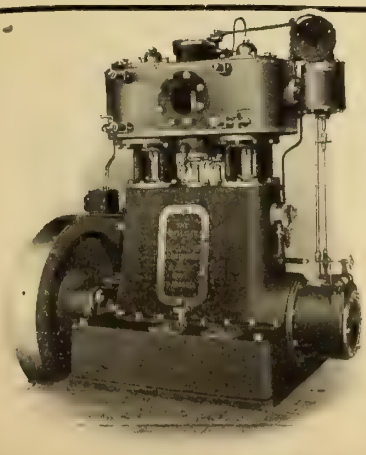
Explanations of Switch and Signal Circuits. Published in 1907 by Doran & Kasner. 140 pages. Price 40c.

Practical Methods of Electro-Chemistry, by F. M. Perkin, Ph.D. Published in 1905. 322 pages. Price $1.00.

Treatise on Thermodynamics, by Dr. Max. Planck. Published in 1903. 272 pages. Price $1.00.

Text-Book of Electrochemistry, by Svante Arrhenius. Published in 1902. 344 pages, illustrated. Price $1.00.

HUGH C. MacLEAN, LIMITED
220 King Street West - Toronto, Ontario



Vertical, Forced Lubrication
Quick Revolution Engines
With Combined Throttle and Expansion Governor

These engines are giving excellent service wherever installed. They are built for service and are economical in consumption of steam and require little or no attention while running. The materials used are in accordance with British Admiralty Specifications. Ask for detailed information.

All Engines are Tested under Steam before leaving our works

THE GOLDIE & McCULLOCH COMPANY, LIMITED
Head Office and Works: Galt, Ontario, Canada
Branches:—Toronto Montreal Winnipeg Vancouver and St. John, N. B.

Westinghouse
Portable Ozonizers

The public has been awakened to the importance of pure air indoors and are ready to buy **Westinghouse Ozonizers.**

Westinghouse Portable Ozonizer
(White Enamel Finish.)

One of these ozonizers will produce sufficient ozone to purify the air in a room of ordinary height 40 feet square. A switch on top of the case regulates the output in ratio of one to four. They operate without the noise of moving parts and may be left running in a bedroom without the slightest disturbance.

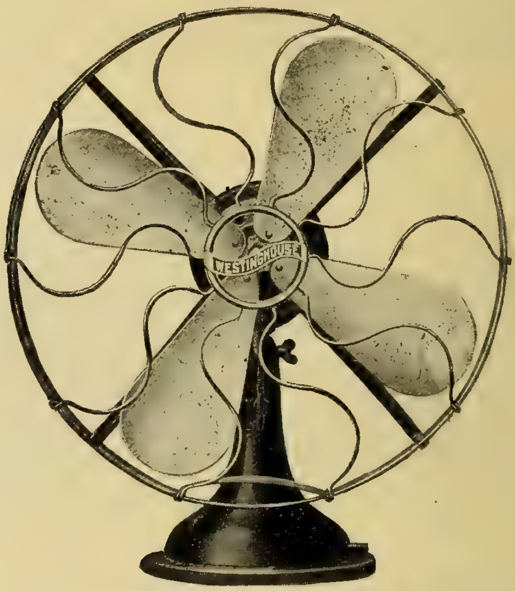
Besides removing odors, ozone attacks any bacteria or germs that may be present, making the atmosphere sterile and healthful.

Westinghouse Portable Ozonizers are made in two standard styles, one with a polished mahogany finished top and bottom, with the metal part of the case a dull black, suitable for offices, clubs, schoolrooms, churches, theatres, etc.; the other style is white enamel all over, appropriate for hospital wards and bedrooms.

Folder 4242 for full particulars

Westinghouse
Electric Drawn Steel Frame Fans

The light weight and pleasing design of these drawn steel frame fans made them great sellers last season.



Desk and Bracket Fan

Central Stations and Dealers who standardize on Westinghouse Drawn Steel Frame Fans have a decided advantage. These fans are 30 to 40 per cent lighter than cast iron frame fans; they are highly efficient and cover the field with a complete line, including the following types:

Desk and Bracket	8-inch 12-inch 16-inch
Residence Six Blade	12-inch 16-inch
Mechanical Oscillating	12-inch 16-inch
Air Operated Oscillating	12-inch 16-inch
Telephone Booth	8-inch
Ceiling	32 and 56 in. A. C. 32, 54 and 57 in. D.C.
Floor and Counter Column	56-inch A. C. 57-inch D. C.
Exhaust Fans	12-inch and 16-inch Blackman Blades 12-inch and 16-inch Westinghouse Blades

Send for Art Circular 1165, Folders 4100 and 4101, Flyers 4232 and 4244, and other advertising helps and ask about our attractive contract proposition.

Canadian Westinghouse Co., Limited, Hamilton, Ontario

Toronto	Montreal	Ottawa	Halifax	Winnipeg	Calgary	Vancouver
Traders Bank Bldg.	52 Victoria Square	Ahearn & Soper, Ltd.	Telephone Bldg.	158 Portage Ave. E.	311 8th Ave. W.	Bank of Ottawa Bldg.

DON'T READ THIS

It's a waste of time if you have no Electrical Equipment, motors, lights or phones.

BUT YOU HAVE?

GOOD!

You'll be interested then in the fact that there's a firm **with every appliance for thorough quick repairs to motors and dynamos of any make or style** and longing to become acquainted with you.

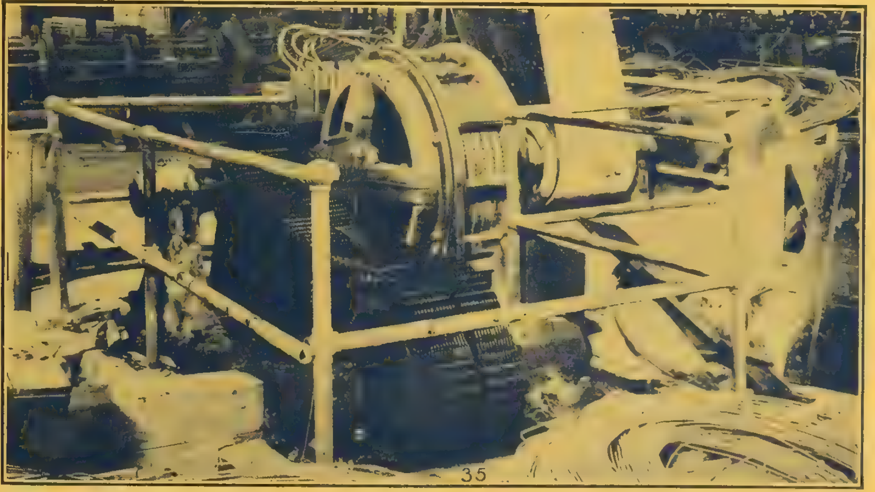
We have a staff of Experts available for out of town repairs. Also a complete stock of supplies, fuses, lamps, etc. Write us for bargains in used machinery.

The Electrical Maintenance & Repairs Company, Limited

Long Distance Phones A-902-903
162 Adelaide Street West, TORONTO
Nights, Sundays and Holidays
Geo. T. Dale, Mgr. Beach 1723

Renold Patent Silent Chain

RELIABILITY ***DURABILITY*** ***EFFICIENCY***



125 H.P. RENOLD SILENT CHAIN Driving Wire Drawing Frame. One of Seven Similar Drives in Prominent Canadian Plant.)

Repeat Orders from Users of Drive Illustrated are Best Evidence of Satisfaction Given Under Most Severe Conditions.

This Drive which has been in continuous (Night and Day) operation since September, 1908, frequently transmits 50-75% overload.

Write for Catalogue

JONES & GLASSCO, Engineers, Sole Canadian Agents **MONTREAL**
(REGISTERED)

We stock Chain and Repairs.

We can keep you running while we make your repairs.

Our repairs will keep you running satisfactorily afterwards.

Fred. Thomson & Co.

326, 328, 330 WEST CRAIG STREET - - - MONTREAL

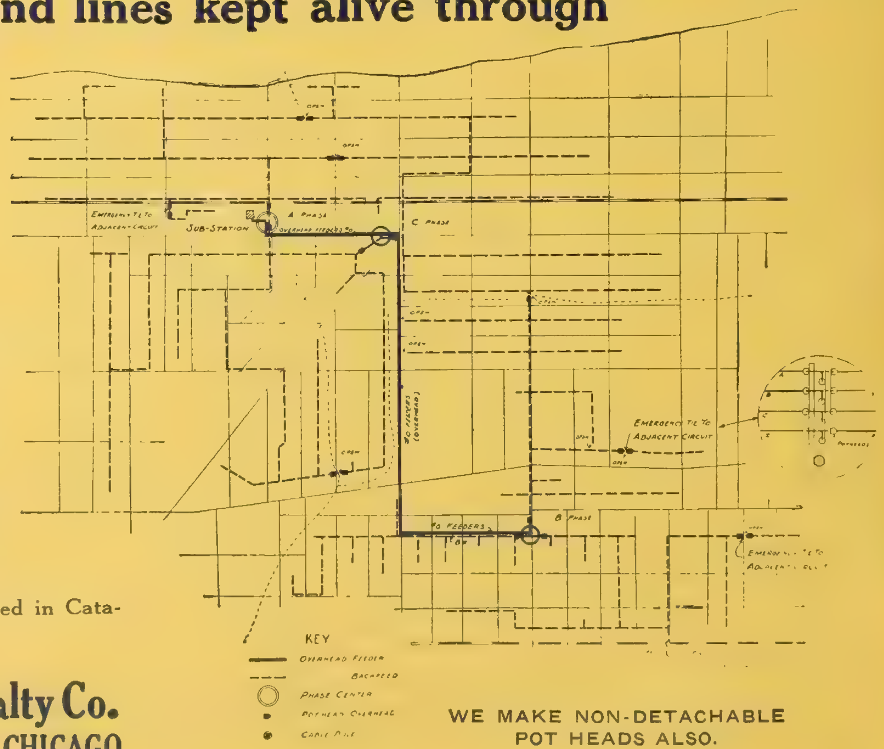
Phones Main 3149 and 6817 Night Phone, Westmount 518 and 3666

Let us quote you on second hand——— GENERATORS, MOTORS, ARC LAMPS, Etc.

WE HAVE THE LARGEST STOCK IN CANADA

Still Another Circuit on which Service Interruptions are minimized, and lines kept alive through the use of

G&W ELECTRIC SPECIALTIES



THE diagram here presented shows a typical circuit equipped with G & W Type "S" Detachable Pot Heads as disconnectives for taps and for switching purposes where feeders are out of service.

The use of G & W Specialties prevents loss of time in locating trouble and saves you money by keeping your lines alive. No cutting or re-splicing of cables.

These devices are fully described in Catalog No. 7. Have you a copy?

G & W Electric Specialty Co.

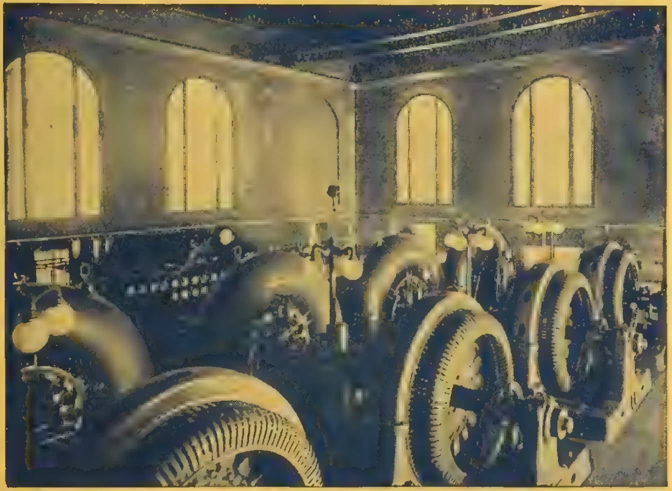
6308-10 Washington Avenue, CHICAGO

WE MAKE NON-DETACHABLE POT HEADS ALSO.

9

Electrical News

Generation, Transmission and Application of Electricity



"Smith" Francis Turbines

Power house of the Metropolitan Water and Sewerage Board, Clinton, Mass. (now owned by State of Massachusetts), where we have four hydraulic turbine units, each of 1600 Horse Power, under 100 ft. head, in constant operation. Turbines designed for heads from 5 feet to 600 feet.

SEND FOR BULLETIN N

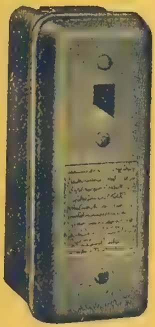
S. Morgan Smith Co., York, Pa.

Branch Offices: 176 Federal St., BOSTON, MASS.
644 American Trust Bldg., CHICAGO

Lightning Arresters

Give Protection When Needed

Your "Lightning Troubles" at an End



Type M Form D 2
D. C. Arrester

Anticipate probable trouble by protecting your line with *C.G.E.* Lightning Arresters. They represent the Latest Ideas in Protective Apparatus and have long been

"THE STANDARD."

Graded Shunt Resance Multigap A.C. Arrester Form F-1.

Canadian General Electric Co., Limited

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Electrical Wires and Cables

Bare and Insulated Copper Wires and Cables.

Bare and Insulated Electric Wire and Cables for Aerial and Underground Use.

Railway Feeder and Trolley Wire.

Weatherproof Magnet and Rubber Covered Wires and Cables.

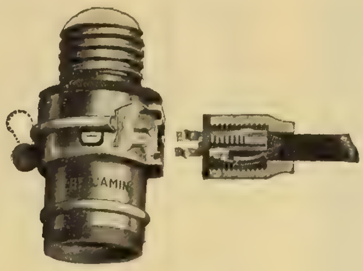
Incandescent and Flexible Cords.

Telephone, Telegraph, Lighting, Power and Street Railway Wires, Cables and Equipment.

Eugene F. Phillips Electrical Works, Limited

MONTREAL - - CANADA

Branches: HALIFAX TORONTO WINNIPEG VANCOUVER



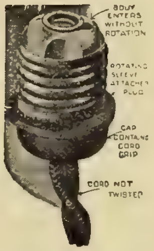
Cat. No. 96

Cat. No. 98

Cat. No. 92

A "BENJAMIN" IN TIME SAVES NINE KINDS OF TROUBLE

Cat. No. 66609



Cat. No. 9-0-3

Your troubles were considered when every "Benjamin" device was designed.

Every "Benjamin" device is a real trouble saver.

CATALOG C-21

is full of them.

Look through your copy.

Cat. No. 597

Cat. No. 68224

"BUY BENJAMIN"

Made in Canada

FROM YOUR JOBBER

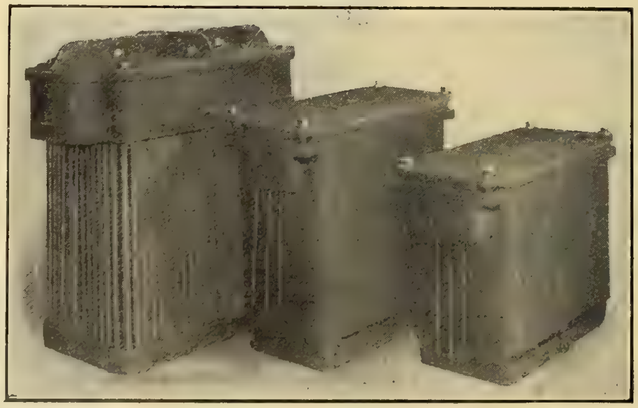
Benjamin Electric Mfg. Co.

of Canada, Limited

11-17 Charlotte Street, Toronto

Glass Case—Top Connections

Steel Case—Top or Bottom Connections



Three Phase Pole or Station Transformers

Ferranti Meters

Accurate and Reliable

Ferranti Meters embody that simplicity of construction which assures perfect accuracy and permanent reliability. Their efficiency under light or heavy loads of short or long duration has been proven to the satisfaction of hundreds of constant users.

Cyclometer or clock dials; top or bottom connections.

Every meter carefully inspected and tested before leaving our factory.

Prompt shipments made from our large stocks at Toronto and Winnipeg.

Ferranti Transformers

Efficient and Economical

Of all transformers the three phase type is the most economical to operate and most saving in construction costs.

The efficiency of Ferranti Three Phase Transformers is apparent because of the great reduction in energy-loss. The transmission line thus equipped is invariably a profitable one.

All coils are wound with copper of ample sectional area, thereby reducing copper losses to a minimum.

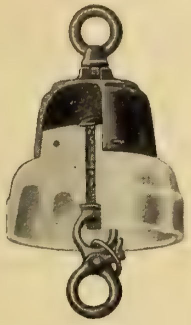
Write for Further Particulars and let us make an estimate for you.

The Ferranti Electrical Co.

of Canada, Limited

90 Sherbourne St.
TORONTO
and
56 Albert St.
WINNIPEG

Ajax Cross-Arm


Jupiter Insulator

Swinging Insulator

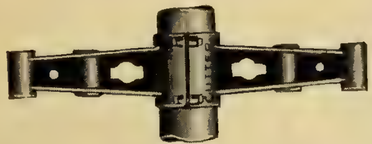
Triple Insulation Arm

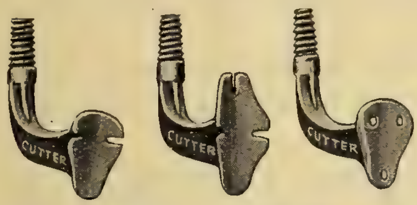
High Voltage Insulator

Write Cutter

Into the Specifications For Your Next Lot of Pulleys and Windlasses Insulators and Cross Arms Pole Line Material

Fixed Pin Clamp Arm

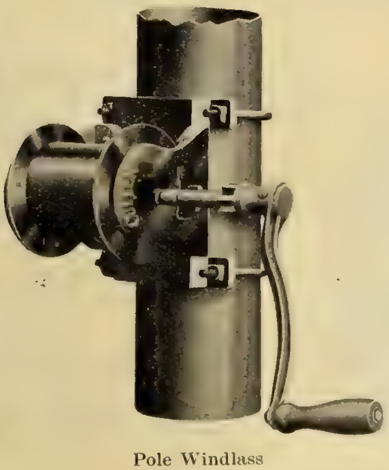

Four Wire Feeder Arm


Fixed Pin Pole Brackets

Swivel Pole Pulley

Sleeve Pulley

Lamp-Supporting Pulley with Clamp Knob


Pole Windlass

Do this, and you will begin to put your line construction on a permanent basis.

Every piece of Cutter material put on the market is designed for long, hard service—all dimensions are liberal—all material carefully selected—all workmanship of the very best.

Pages 31 to 40 of our Catalog No. 12 go into detail—pages 1 to 30 and 41 to 136 are interesting too. Ask us to send Catalog No. 12.

George Cutter Co.

423 Notre Dame Street

South Bend, Indiana, U. S. A.

We specialize as follows:

Street Railway Supplies
Pole Line Material
Hot Point Heating Apparatus
Tungsten and Carbon Lamps
Lighting Fixtures
Wires and Cables
Arc Lamps and Carbons
General Supplies of all kinds
Car Heaters and Trucks
Headlights and Panel Boards
Telephones and Transformers

Let us quote you prices. It will save you money.

Dawson & Company, Limited, **Winnipeg Montreal**

Monarch Electric Co., Ltd.

St. Lambert, P. Q.

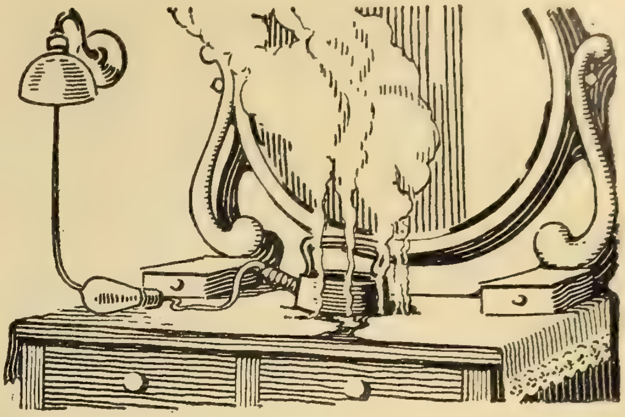
Phone Main 3988 Montreal Exchange **District Montreal**

A few of the Monarch Canadian Made Specialties manufactured in this, our own building, are:

Sockets—Rosettes—Attachment Plugs
Lamp Guards—Knife Switches

Oil Circuit Breakers
Switchboard Accessories
Switchboards
Transformers for Instruments

Many Fires Have Started This Way



A guest at a hotel takes a lamp out of a socket, attaches an electric iron or other heating device, and leaves the room with the current on.

The result is usually a fire, or at the very least a scorching of the dresser, blowing of fuse, etc.

Such fire hazard, not to mention theft of the lamps, etc., can be absolutely prevented by use of the

Shurlok

"The socket that locks"

FOR SALE BY ALL JOBBERS

Carried in Canada by the jobbers listed below who will gladly give you further information and give you the names of Canadian installations. For free booklet use the coupon.

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Dawson & Company, Limited	Montreal
Central Electric & School Supply Company	Toronto
Mainer Electric Company	Winnipeg
Dawson & Company	Winnipeg
General Supplies Limited	Calgary, Alta.
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Main Office and Works:

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New York City
178 Fulton Street

San Francisco
Rialto Building

Chicago, 700 West Jackson Blvd.

PASS & SEYMOUR, INC., Solvay, N. Y.
Please send free copy Shurlok booklet and Catalog 20.
Name ....
Address ....
City ....
State ....
Coupon No. 111

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Copyright Canada 1913 by E.A.Victor
CALGARY FURNITURE STORE LIMITED

Calgary Furniture Store—A "GALVADUCT" Building

"GALVADUCT"
AND
"LORICATED"

The two brands that stand for what is latest and best in conduits.

"GALVADUCT"—The most perfect interior construction conduit on the market.

"LORICATED"—A high-class interior construction conduit of the enamelled type.

Always use Galvaduct or Loricated

Conduits Company
Limited
Toronto - Montreal

The Lachute Shuttle Co., Limited

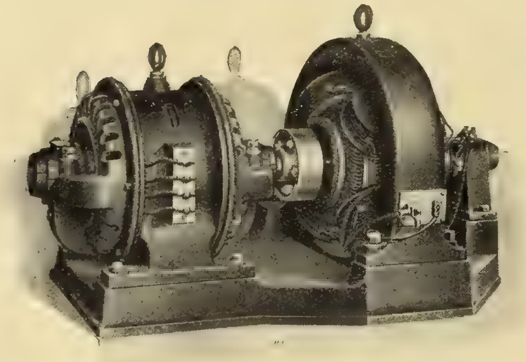
Lachute Mills—P.Q.

Manufacturers of

Cross Arms—Space Blocks—Birch and other Hardwood Insulator Pins and Brackets.

Toronto & Hamilton Electric Company

HAMILTON



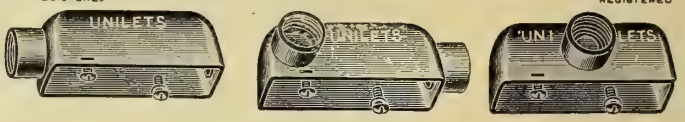
MOTORS FOR ALL CIRCUITS

DYNAMOS FOR POWER AND LIGHT AND ELECTROPLATING

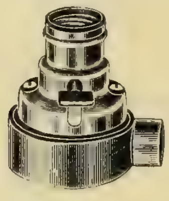
Repairs executed neatly and promptly

Write us

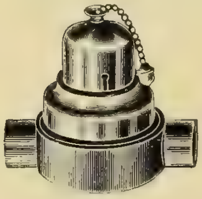
Drawn Steel UNILETS



Rectangular Steel Unilets for ½-in. to 3-in. Conduit Inclus



Type No. 1 Snap Switch Unilet with Bryant Key Socket Attached



Type No. 2 Snap Switch Unilet with Hubbell No. 5795 Pull Switch attached

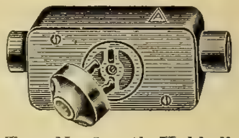
If you want your installation to be up-to-the-minute in appearance and durability insist upon

UNILETS

A very few of the types are shown herewith. In our catalogue No. 6 and booklet you will find listed a complete line of Unilets and other conduit fittings. Send in your request for catalog and booklet at once.

Type No. 2 with Push Button Switch Attached

Type No. 2 with P&S No. 577 Receptacle Attached



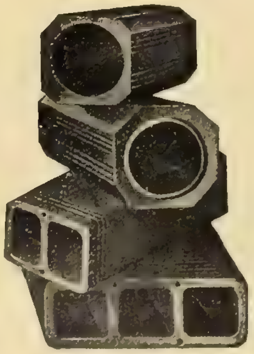
Type No. 2 with Hubbell No. 5418 Receptacle Attached

APPLETON ELECTRIC CO.

212-214 North Jefferson St. - - CHICAGO, ILL.

FOR SALE BY

Chapman & Walker, Ltd., Toronto. The Mainer Electric Co. Ltd., Winnipeg. Marshall Wells Co. Ltd., Winnipeg Montreal Electric Co. Ltd., Montreal.

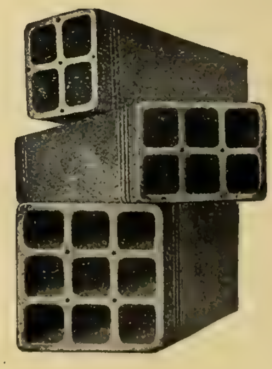


Clermont Sewer Pipe Co.

Multiple and Single Duct Conduit for Underground Work

We challenge the world on finish and durability of our material. Our plant is located giving us the lowest freight rates to Canada.

B. S. BARNARD, Vice-Pres. **50 Church St., New York City**



Metal Case Type K

Polyphase Type PK

Meter Logic

So much depends upon the accuracy and reliability of your meters that you cannot afford to install anything but the **tried** and **tested** variety. Derangement or inaccuracy of the instruments means either a loss of dollars to you or dissatisfaction to your customers. **Both of these conditions must be avoided.**

"PACKARD" Meters

are known throughout Canada and acknowledged by electrical men who know, as the standard for accuracy, reliability and permanence.

The Packard Company was the first company in Canada to manufacture induction meters. The acute importance of the watthour meter was recognized at the beginning, both from the standpoint of the central station and the customer, and every care has been taken to insure "Packard" Meters against the slightest defect.

Large stock carried at

St. Catharines and Winnipeg

St. John Railway Co.,
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Factory at ST. CATHARINES, ONTARIO

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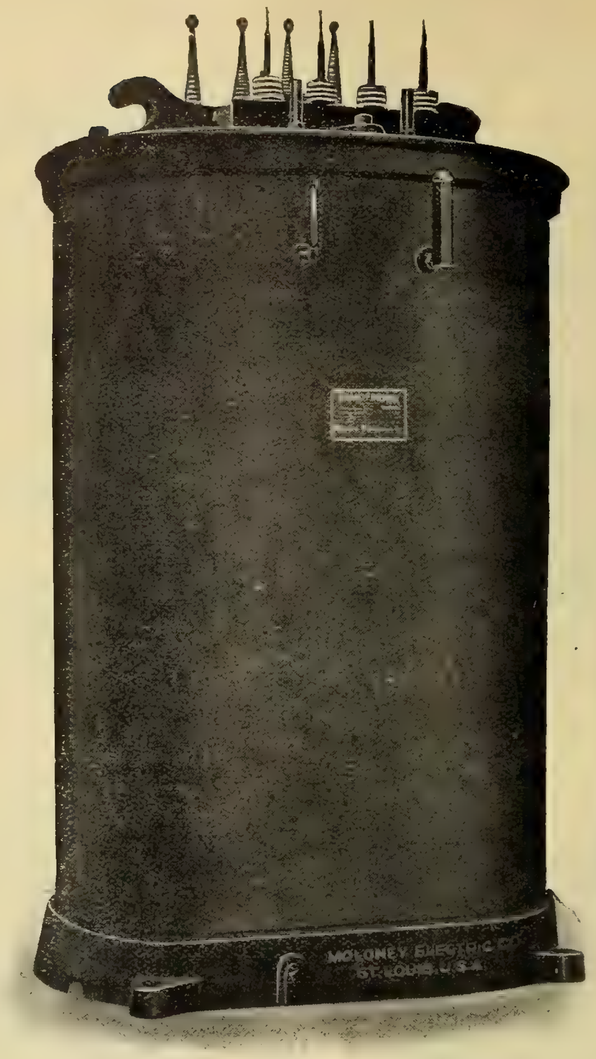
1897

16 Years Satisfactory Service



Type E, Water-Cooled, 100 to 5000 K.V.A.

1913

16 Years Satisfactory Service

MOLONEY

You can depend on Moloney Transformers to stay on the job whether they are installed on the line or in the station. No transformer is capable of higher efficiency and lower core and copper losses than the Moloney. It is the coolest transformer on the market and has been in successful operation for sixteen years.

Our illustrated catalogue explains the meritous points of Moloney Transformers. Write for your copy.

Canadian Moloney Electric
Company, Limited

Office and Works: WINDSOR, ONT.

COMPLETE STOCKS
WINDSOR WINNIPEG VANCOUVER

When You Say

SINGLE PHASE MOTOR

You Think Of

WAGNER ELECTRIC

For twenty years the Wagner (induction repulsion) Single Phase Motor, known as type BA, has been the Standard of the World. That it retains this position is evidenced by the fact that we are making more of these motors to-day than ever before. We will continue to build the BA type. Bulletin 8313 will tell you all about it.

WAGNER ELECTRIC MANFG. COMPANY OF CANADA LIMITED
Wagner Quality
MONTREAL, P.Q.

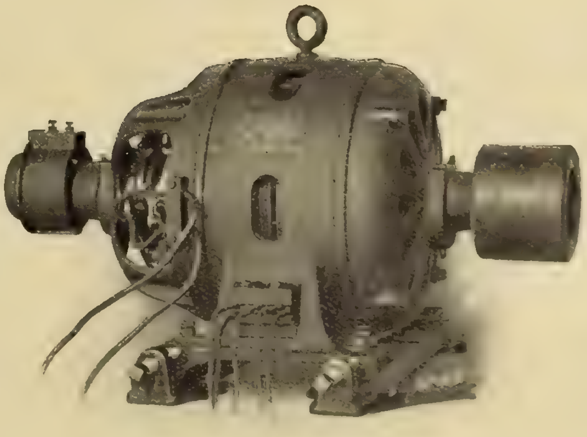
NOW WE HAVE ANOTHER TYPE!

The Small Users

UNITY POWER FACTOR MOTOR
THE WAGNER BK

For Improving Power Factor

This marks a great advance in the motor art. Improves voltage regulation. Increases earning capacity. Reduces fixed charges. Produces dividends. Bulletin 9413 tells the story.



WAGNER ELECTRIC MFG. CO. OF CANADA, LTD.

Guardian Building, Montreal

CANADIAN GENERAL ELECTRIC CO, LIMITED.

HEAD OFFICE, TORONTO.

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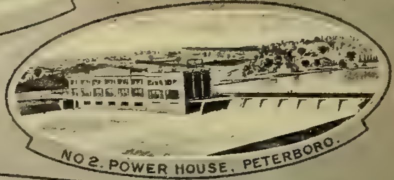

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ELECTRICAL SUPPLY WORKS, TORONTO.

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DISTRICT OFFICES

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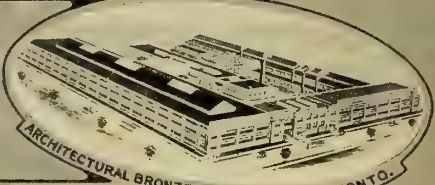

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CARBON & TUNGSTEN LAMP WORKS, TORONTO.

TUNGSTEN LAMP WORKS, MONTREAL.

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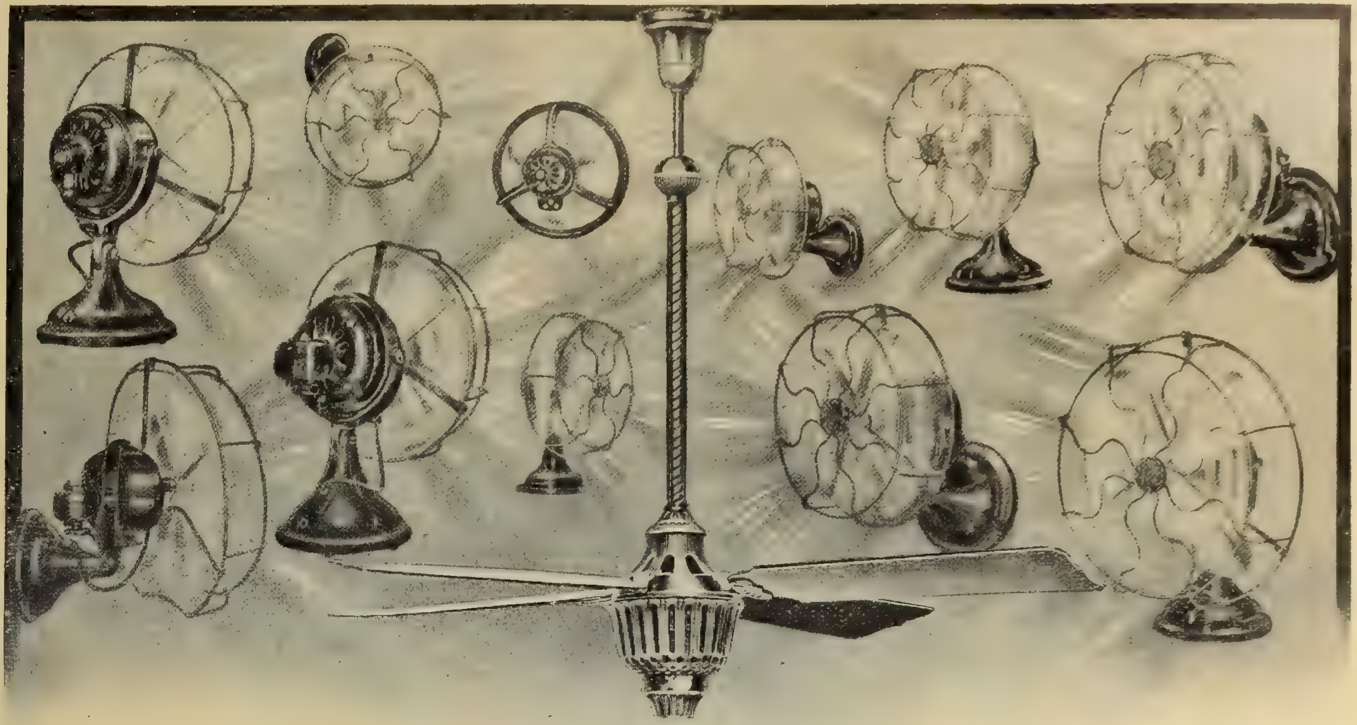
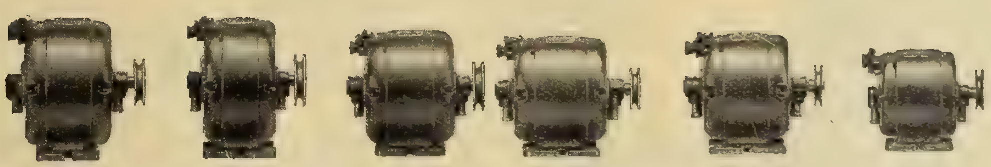


Superior Design **Reliability**

Electric Fans for 1913

Complete in all standard styles and sizes, both alternating and direct current, for residence and commercial uses.

Small Power Motors



C. G. E. Drawn Shell Small Power Motors are unique in the simplicity and compactness of their design. Hundreds of them are in daily use giving perfect service under a wide variety of conditions.

Canadian General Electric Co., Limited

Head Office: TORONTO

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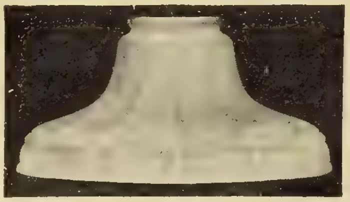

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The New

SUDAN GLASS

Panelex Design

No. 01213

SUDAN GLASS is an absolutely new chemical composition.

It is different in every characteristic from every existing opal.

Perfectly uniform in texture, with no specks or other flaws in its surface.

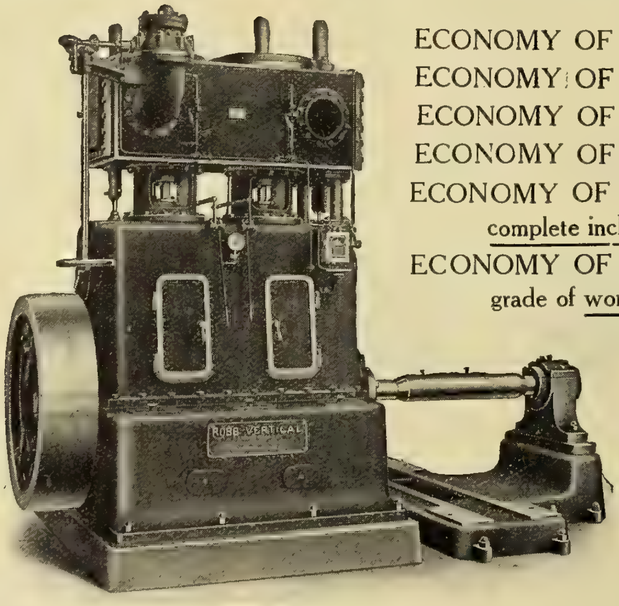
New in design, distinctively alone in quality

All sizes, for from 25 to 500 Watt lamps

THE HOLOPHANE CO., LIMITED

TORONTO - CANADA

Economy—The Greatest Word in Engineering



ECONOMY OF STEAM requires a compound engine.

ECONOMY OF SPACE requires a vertical high-speed engine.

ECONOMY OF POWER requires automatic governing.

ECONOMY OF TRANSMISSION requires direct connection.

ECONOMY OF ATTENDANCE requires automatic forced lubrication and complete inclosure of all moving parts.

ECONOMY OF MAINTENANCE requires an up-to-date design, highest grade of workmanship, and interchangeable parts.

All these Economies are Assured in the

ROBB COMPOUND ENGINE

Ask for Bulletin No. 201

INTERNATIONAL ENGINEERING WORKS, LIMITED

MANUFACTURERS OF

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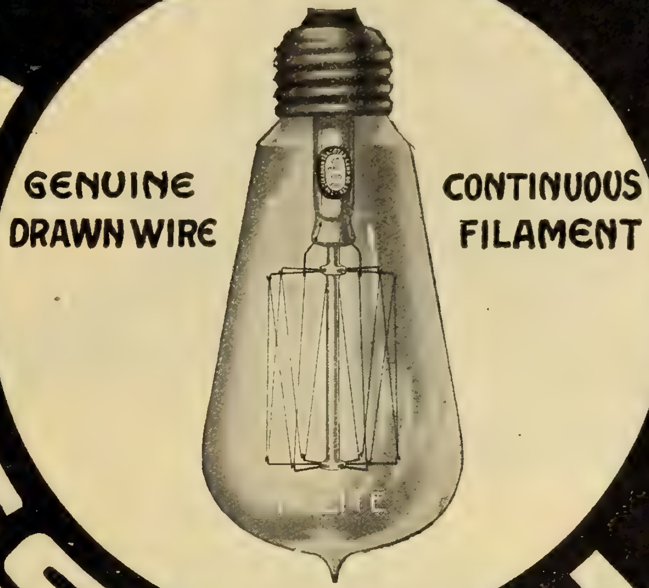
39-45

"NULITE"

TUNGSTEN LAMP



"The Lamp With a Record"

The Highest Degree of Lamp Manufacture.
Unequalled in Life, Efficiency, Durability.

Prompt Deliveries From Stock

"NULITE"

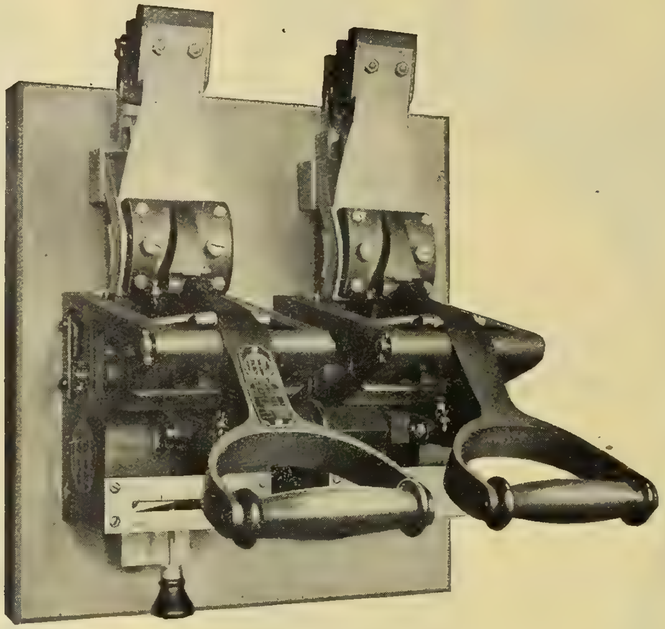
A Canadian Product Manufactured by

THE CANADIAN TUNGSTEN LAMP CO., LTD.

HAMILTON, ONT.

Branch Warehouses at: **Montreal**—246 Craig St. W. **Winnipeg**—56 Albert St. **Vancouver**—365 Water St.

AGENCIES: T. McAvity & Son, St. John, N. B.; Farquhar Bros. Ltd., Halifax, N. S.;
Mechanics Supply Co., Ltd., Quebec, Que.; Dominion Illuminating Co., Ltd., Toronto Ont.



Consideration of

Space Economy

is often of great importance in the design of the switchboard, and this point we have borne in mind in the development of our apparatus aiming to produce for each class of service the Circuit Breaker best adapted to the end in view, embodied in the smallest dimensions consistent with satisfactory performance.

The I-T-E Dublarm

Circuit Breaker, N-X Type, illustrated at the top of the page is a striking instance of this development. It is widely used for the protection of direct current lighting and power feeders of 250 volts or less, and is also well adapted for the protection of individual motors.

THE CUTTER COMPANY, Main Office and Factory **PHILADELPHIA**

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Eccles & Smith Co.. 71 First Street, San Francisco, Cal.
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Two Leaders for Big Summer Business

You can make the hot weather one of the most profitable seasons in your whole business year. Warm weather creates a demand for some of the most profitable lines you can handle.

There is no slack season for the dealer who is alive to his opportunities.

Be prepared to get your full share of this summer's business in electric irons.

The American Beauty has all the refinements that can be put into a flat iron. Expense has not been spared in its production. It is designed for the highest efficiency and is most attractive in appearance. Finished in polished nickel. Weight 6½ lbs.

The Triangle Lektrik iron is a low-priced iron that is exceedingly good value for the money. It performs its work in a most satisfactory manner. The Triangle Lektrik is finished in polished nickel and very attractive in appearance. Weight 6 lbs. The most reliable low priced iron on the market.

The heating element in these irons are guaranteed for all time.

Ask us to send you a supply of advertising matter. This will greatly assist you in pushing the sale of these irons, as well as of other warm weather electrical household appliances.

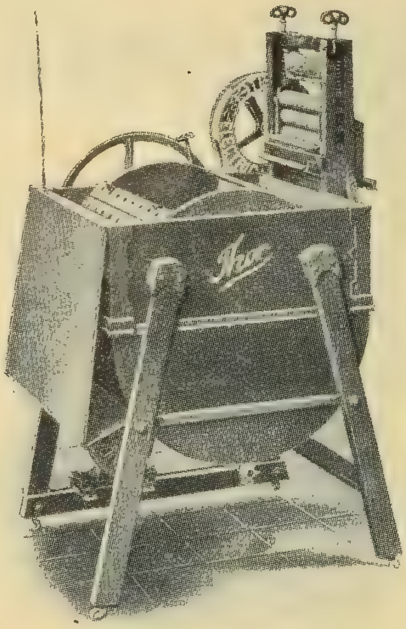
THE Northern-Electric AND MANUFACTURING CO. LIMITED

Manufacturer and Distributor of Telephone and Fire Alarm Apparatus and Electrical Supplies for every possible need

MONTREAL HALIFAX TORONTO WINNIPEG
REGINA CALGARY EDMONTON VANCOUVER

A FEW REASONS

For the Extraordinary Success of the



THOR ELECTRIC WASHER

The THOR is equipped with a guaranteed motor.

Requires no expensive line shaft.

Has an automatic self reversing cylinder.

Has a specially designed reversible wringer.

Requires no special wiring.

Operation is extremely easy—there are no intricate parts to adjust and a turn of a switch controls it instantly.

Write for descriptive literature

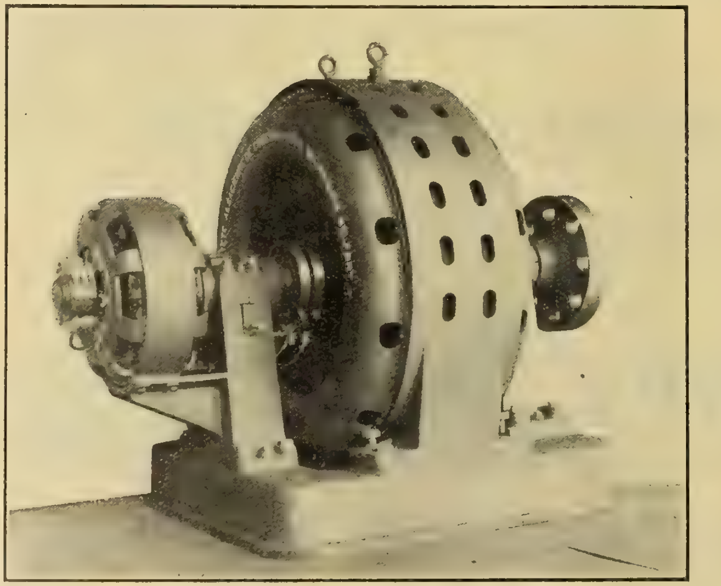
The Mainer Electric Co., Ltd.

Winnipeg, Man. - Edmonton, Alta.

The Largest Electrical Supply House in the West

Engineering Works of Canada, Limited

Head Offices: NEW Birks Building, MONTREAL, QUE.



A. C. Generator with Directly Connected Exciter.

Descriptive Pamphlet of our Generators mailed upon request

Builders under the patents of the

Societe Alsacienne

Belfort, (FRANCE) Mulhouse, Grafenstaden (GERMANY)

ESTABLISHED 1826

Power Plants, Rolling Mills, Mining and Hoisting Machinery

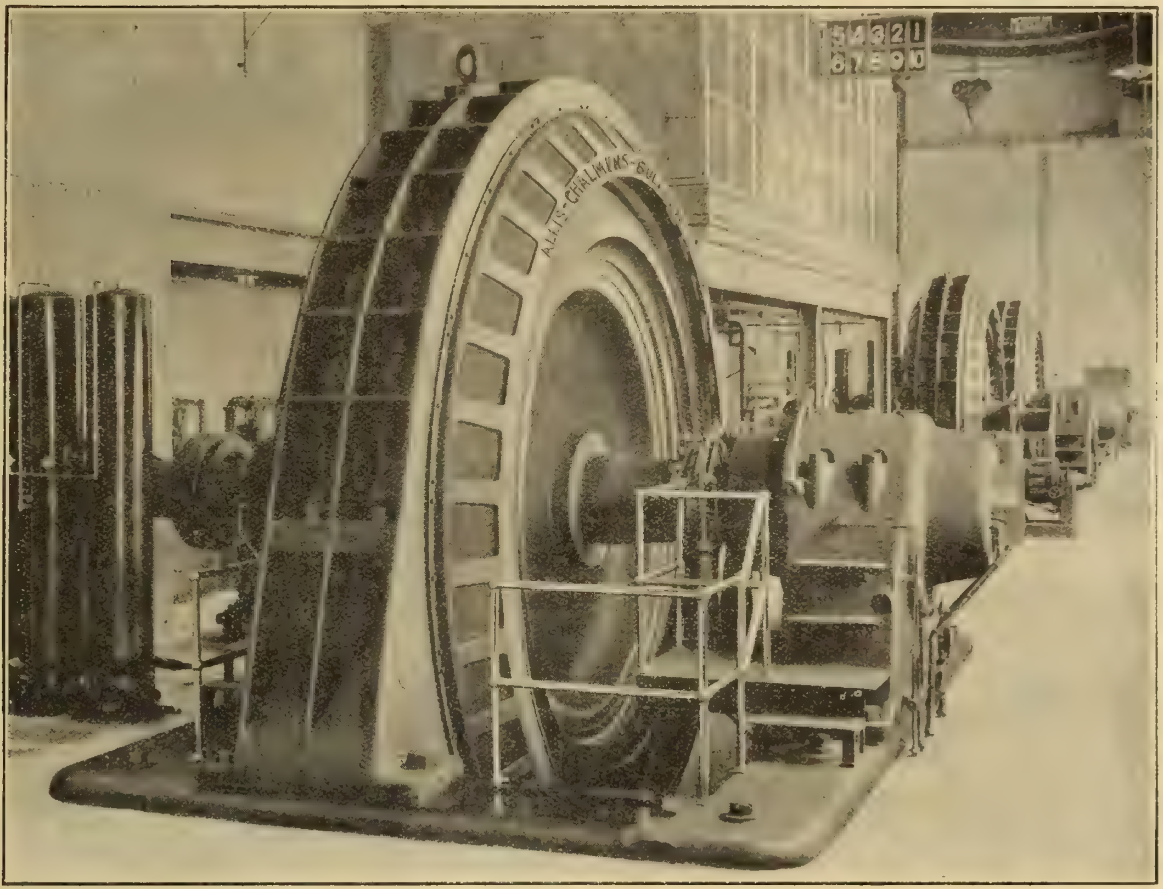
STIGLER'S

Patented Passenger and Freight

ELEVATORS

WATER WHEEL TYPE OF

GENERATORS



3 Alternators each 5,000 K.V.A. 60 Cycle, 3 Phase

in the St. Timothee Power House of

The Canadian Light and Power Co.

built by

CANADIAN-ALLIS-CHALMERS

LIMITED

WORKS - - - MONTREAL

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TORONTO, 810 Traders Bank Bldg.
WINNIPEG 601 Builders Exchange Bldg.
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COBALT
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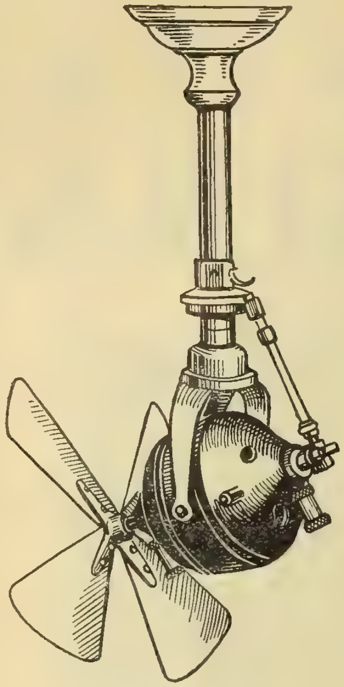
The Fan Season is Now Here



CEILING FAN
(Self Rotating)

FANS LEAD ALL OTHERS

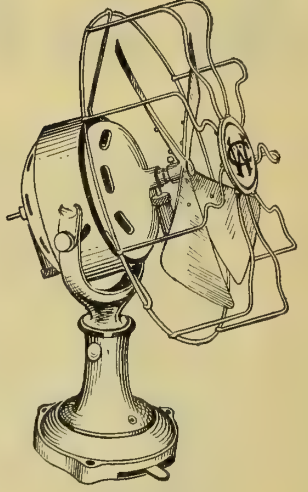
C & W fans are attractively designed and noiseless in operation.

C & W oscillating fans are the neatest and most perfect on the market.

C & W Self Rotating ceiling fans are much superior to anything heretofore offered.

You will be asked for C & W Fans.

Write us for catalogue and prices



DESK FAN
(Oscillating)

CHAPMAN & WALKER, Limited

118-120 Richmond St. W., TORONTO, ONT.

VANCOUVER WINNIPEG MONTREAL

Protection from Lightning Troubles

The following list of users of the Mosciki System of Lightning Protection speaks for itself:

- Victoria Falls and Transval Power Co.
- Shanghai Municipality.
- Melbourne Electric Supply Co.
- Cleveland and Durham Power Co.
- St. John Del. Key Co., Brazil.
- Societa Dergano.
- Sociedad Espanola, Madrid.
- Societa Electrica Suburbana, Milan. &c.

(MOSCIKI SYSTEM)

Lightning, if unchecked, will break the windings of your apparatus, blow out your fuses and break down your transformers.

In short, lack of adequate and capable lightning protection may mean to you serious loss of time, money, and perhaps lives.

A host of so-called lightning arresters are on the market, but 99 per cent. of them are valueless because the principle on which they are constructed is wrong.

High frequency—not high voltage—is the cause of the damage done by lightning.

Most protective systems work on the principle that high voltage is the cause of the damage. This is incorrect, hence their uselessness.

A lightning protection apparatus to be of any use must offer a clear path to earth for high frequency currents independent of voltage.

The MOSCIKI System of Lightning Protection fulfills this condition absolutely—it's principle is correct—its design the best and its guarantee absolute. Write us for fuller particulars.

Mosciki Lightning Arrester

Exclusive Canadian Agents

CHAPMAN & WALKER, ELECTRICAL ENGINEERS AND CONTRACTORS

116-118 Richmond Street W., TORONTO

Efficiency in Semi-Indirect Lighting

depends very largely on the glassware. If the ***glass*** is right the ***light*** will be right in most cases. That's why

Delica White Glass

is the proper material for semi-indirect bowls. There are no imperfections in this pure white glass. All shadows are absolutely eliminated. And its diffusing properties are remarkable.

¶ You should investigate it now. It is selling very fast. Shall we bring photos?

The Pittsburgh Lamp, Brass & Glass Co., of Canada, Ltd.

113 Wortley Road
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PILABRASGO

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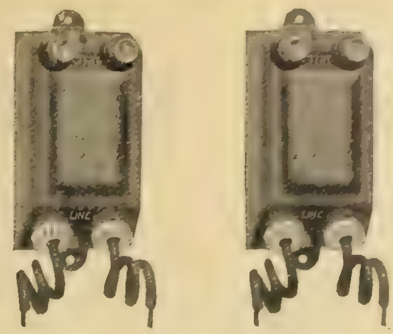
Special Representative



Big Reduction in Price on

THORDARSON'S MODIFIED JUNIOR BELL-RINGING TRANSFORMERS

This new Thordarson product is encased in solid steel. Is fire, fool and moisture proof. Always works efficiently. Short-circuiting cannot impair them in the least. Current consumed will not register on an ordinary meter.

WRITE FOR FULL PARTICULARS AND NEW DISCOUNTS

New List Price $2.50.

For Sale by all Leading Electrical Jobbers

THORDARSON ELEC. MFG. CO.

503 S. Jefferson St. CHICAGO, ILL.

The Lion M Tungsten Lamps

The Ideal Lamp for Business Premises

Strong, reliable manufacture, Long Life, More Light all the time. Specially adapted for use in Offices, Stores and Factories.

TO THE TRADE

We are now ready to fill large or small orders from stock and make immediate deliveries and complete shipments.

Special prices and discounts on trade orders.

In lots of 1,000 and over, we etch on each lamp any name or mark required free of charge.

Samples submitted for testing.

Special quotations made on request write us your requirements

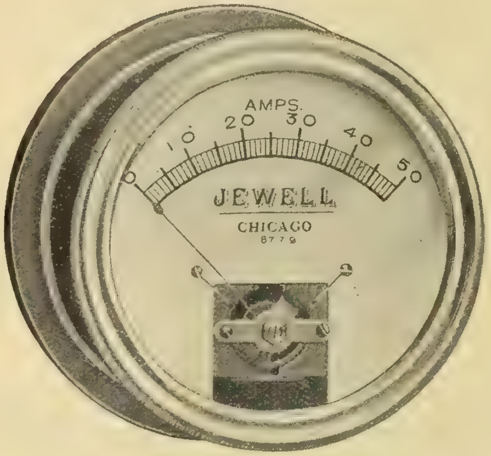
Electrical Products Company, of Canada

28 Wellington St. West (Tel. Main 2298) Toronto

District Agents: EDMONTON—Miller & Miller HAMILTON—C. T. Inman & Co., 157 James St. S.

MARSHALL-DAVIS
— LIMITED —
ELECTRICAL APPLIANCES
DUNNVILLE, - ONTARIO

Agents for Jewel Electrical Company, Chicago

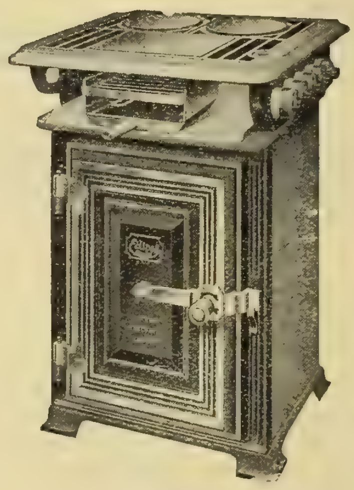


Precision Instruments
for
Switchboard, Laboratory,
Portable, Automobile,
A. C. or D. C.

An Instrument for Every Purpose

PROMPT SHIPMENTS **BROAD GUARANTEE**

"ECLIPSE" COOKERS GIVE SUCCESSFUL RESULTS



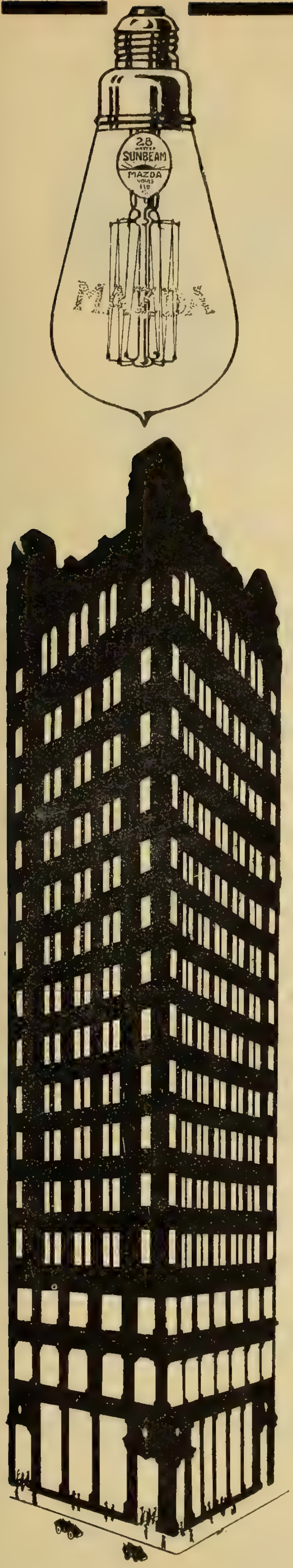
"ECLIPSE" DOMESTIC COOKER

THE LEADING BRITISH-BUILT COOKERS—ACKNOWLEDGED BY ALL USERS

Will do everything a gas cooker will do, except smell and fume. Luminous Radiant Heat in Oven and Grill.

Can be procured in Canada from the Supply Authorities, Electrical Dealers, or from our Montreal office as under.

The Electric & Ordnance Accessories Company Limited
Head Office for Canada :—LEWIS BLDG., MONTREAL
Mr. J. P. I. Thomas (Representative)
Works :—Aston, Birmingham
ENGLAND



A City After Dark

When the sun goes down there are literally millions of electric lamps illuminating every city or town of any size. These lamps in time become burned out and must be replaced. Think of the immense trade there is for the man who carries a complete stock of lamps that enjoy a popular demand.

SUNBEAM
MAZDA LAMPS

are the first choice of the Canadian public because of their proven efficiency and long service.

By the use of Mazda drawn wire filament tungsten lamps a given amount of electric energy can be converted into three times the amount of light than is possible with a carbon lamp. This means more business for the central station both in the lamps and the current supply because "cheaper light means more light."

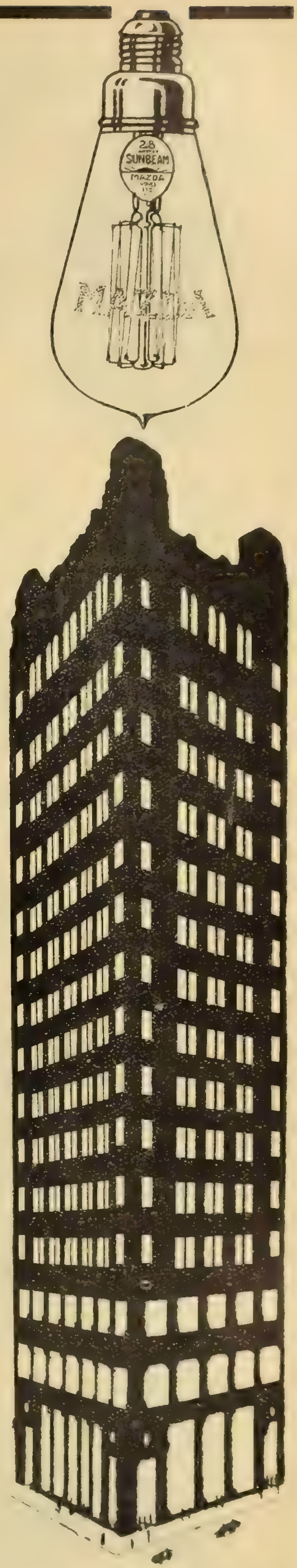
Carried in stock by all dealers, or write us for prices and literature.

Made in Canada by

Canadian Sunbeam Lamp Company, Limited

Main Office and Factory: TORONTO

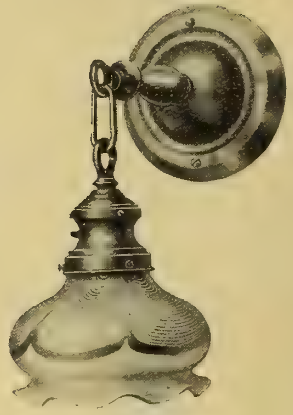
Branch Warehouses:
MONTREAL WINNIPEG CALGARY VANCOUVER



Simple Designs in Standard Tungstoliers

3631

3652



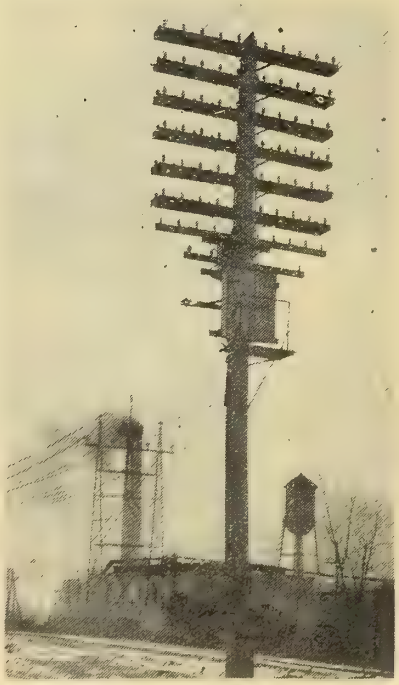
3701

¶ Even in the simple fixtures above shown there is the mark of character and quality which distinguishes Tungstoliers.

The Tungstolier Company of Canada, Limited

Head Office, 212 King St. West,
Toronto

The Steel Company of Canada, Limited



Manufacturers of:—

Galvanized Wires and Strand Wires

Send us your specifications for

Telephone and Telegraph Wires

and we will guarantee satisfaction

District Sales Offices

HAMILTON TORONTO MONTREAL WINNIPEG
VANCOUVER VICTORIA ST. JOHN HALIFAX

The MAN of the HOUR

He TELEPHONES instead of writing, walking, or riding, whenever he can, therefore saves energy and doubles his efficiency.

The more subscribers can be induced to telephone the greater will be the demand for your service and new contracts.

The better the telephones, the greater inducement to use them, and the better the service, the greater the need of it becomes. Here is where really fine equipment is the best possible directory builder.

The telephone today is not used but a fraction of what it will be a few years hence. Therefore, the better the apparatus (which means better service), the faster will its use spread.

Thousands of wasted steps are taken daily; thousands of pounds of shoe leather worn out uselessly, and what is perhaps the most important of all, hours of valuable time are thrown away; 90 per cent of which can be saved by telephoning.

The highest class telephone service known to the telephone field today is exemplified in the Kellogg equipment. Every part in its construction is sound.

Send for our bulletins. They are REAL sources of information. Not merely a description of the apparatus but simple readily understood explanations of its operation.

KELLOGG SWITCHBOARD & SUPPLY COMPANY

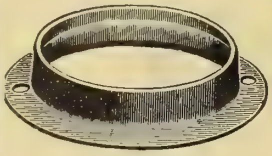
MAIN OFFICE AND FACTORY: **CHICAGO**

REGINA BRANCH: DEERING ELECTRIC LIMITED - WINNIPEG BRANCH: HOUSTON & COMPANY, LIMITED
VANCOUVER BRANCH: B C. HOLST & COMPANY 43 LEIGH-SPENCER BLDG.

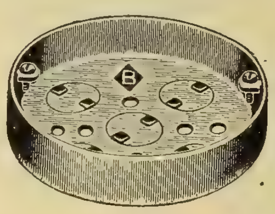
Made in Canada

Iron Conduit—Conduit Boxes—Pipe Fittings and Accessories

No 6350



No. 31



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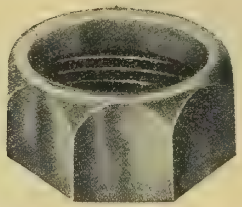
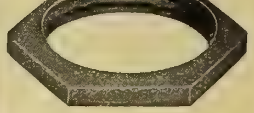
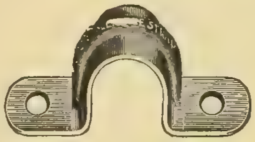
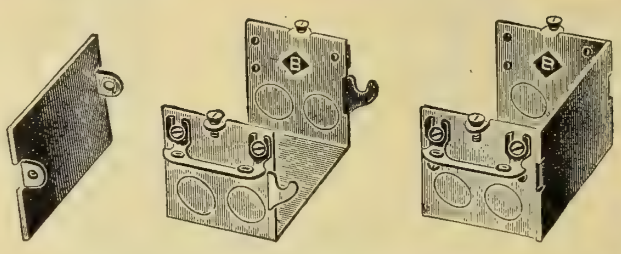


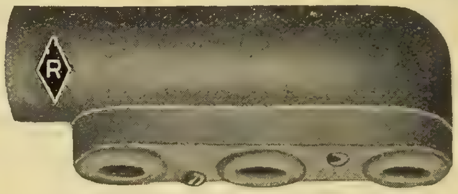


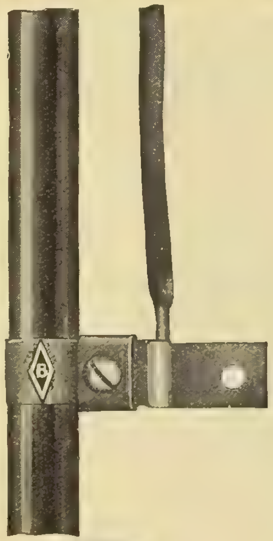


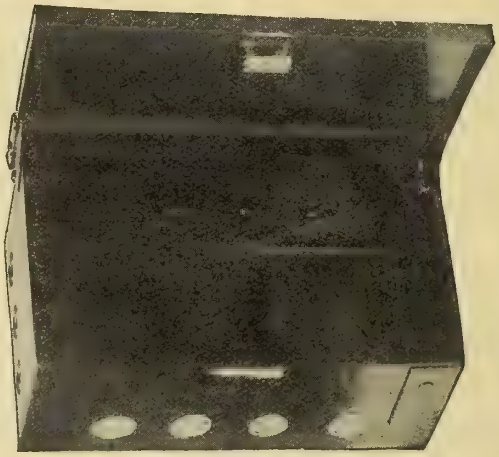


Type S C 3″ deep—C C S-2″ deep
side comes off and does away with carrying two gangs

No. 81A







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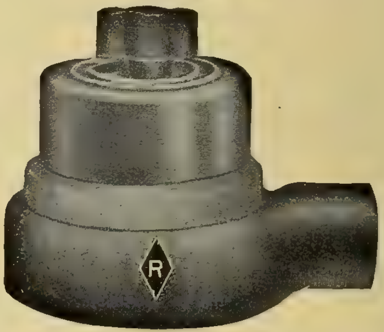

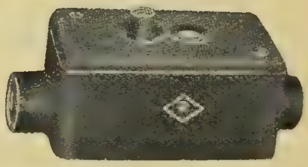

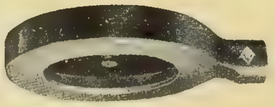

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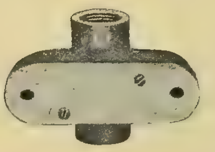

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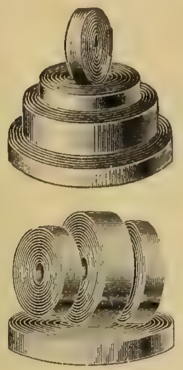

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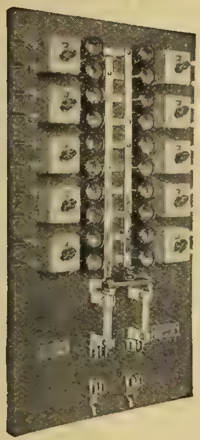

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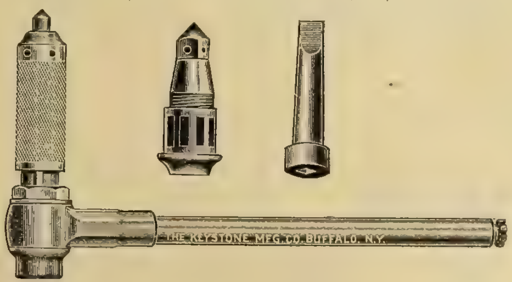
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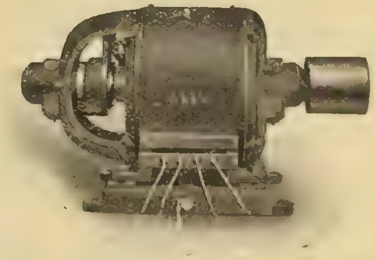

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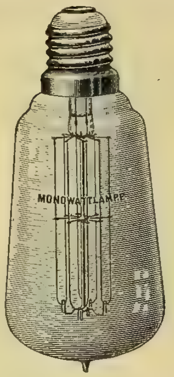

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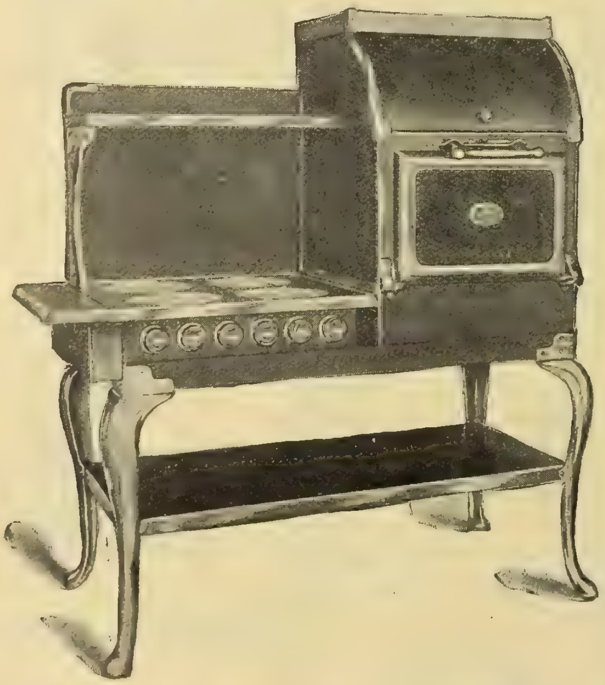

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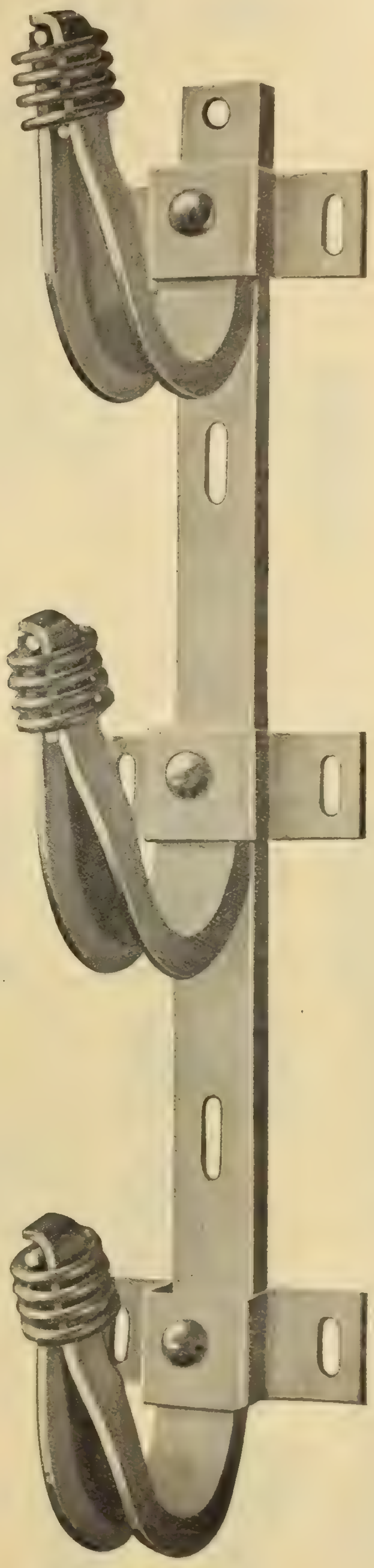

because dozens and scores of Central Stations are finding out that it is a real money saver in service as compared with the common or garden variety that was born with the telegraph and never grew up.

The wide base of this bracket is formed by a broad steel strap, securely riveted to both the pin and the backbone.

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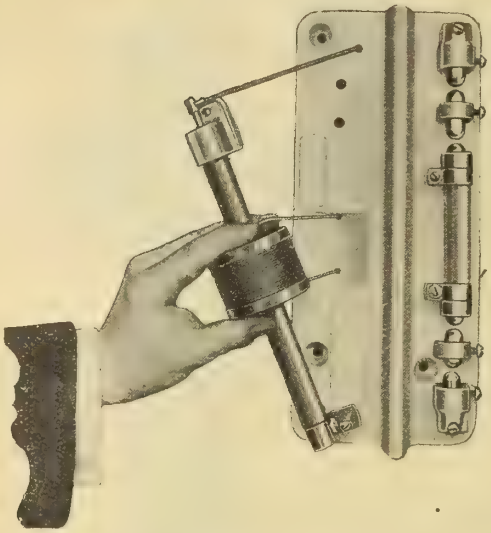

Take the circuit breaker off the Garton-Daniels Lightning Arrester—and you have left everything that any other lightning arrester offers; you have small air gaps for protection; low series resistance for eliminating surges, winking lights and other voltage disturbances; air gaps and resistance for cutting off small and medium flows of current from line to ground. **Leave its circuit breaker off,** and it would at times ground and "short" your lines the same as other arresters not having a circuit breaker.

Put the circuit breaker on, and you get everything any other lightning arrester can give you, and something else—the circuit breaker—the only positive means for eliminating grounds and short-circuits.

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Tackle your lightning protective problems **now**; but in getting arresters consider whether you can afford to buy any type **not** having these **three** features—an incomplete arrester—in preference to the Garton-Daniels—the only "Complete" Arrester made.

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Generation, Transmission and Application of Electricity

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Vol. 22 **Toronto, May 15, 1913** **No. 10**

An Association on Broader Lines

There has prevailed for some time quite a strong feeling in favor of the organization in Canada of an electrical association on somewhat broader lines than any of the existing associations. This statement, while admittedly true, is not intended to be interpreted as questioning the usefulness of such organizations as the Canadian Electrical Association, designed more particularly to protect and promote the interests of privately owned central stations; the Ontario Municipal Electric Association, essentially for officials and representatives of municipal plants; the Canadian branches of the American Institute of Electrical Engineers, composed more particularly of the technically trained engineers; the Jovian Order, and such other organizations as may exist. Each society is doubtless doing some good work and has its enthusiastic supporters. But it is thought that an organization which will bring together men engaged in all branches of the electrical business, for social intercourse and for friendly discussion of technical and commercial problems of interest to all, would result in much good. The tendency to-day is, we believe, towards over-organization—too many requests to join this and that society—but that is no reason why we should not have a comprehensive association, presumably with provincial sections, for the electrical people of Canada.

At a recent meeting in Toronto of the Managing Committee of the Canadian Electrical Association, the advantages of a broader association were discussed. It was clearly shown that there is a strong desire to continue to receive the benefits to be derived from the present affiliation with the National Electric Light Association—benefits which are recognized by every central station company. There were also many present who favored a more comprehensive association, and after an open discussion a resolution was adopted requesting the Electrical News to take steps to gather the opinions of representative members of the electrical industry on the advisability of bringing into existence an organization on broad lines, whether through the C. E. A. or as a separate association being a matter to be decided later. A letter explaining the situation and requesting an expression of opinion has in consequence been sent to a large number of our readers and others who would be interested.

Those who have not already responded to the circular are urged to do so at once, so that the Committee may have the information as soon as possible. If any of our readers have not received a copy of the circular letter they are asked to consider this as an invitation to send in an expression of opinion, as the best results can only follow a very general and prompt response to the request.

New Rules and Regulations

The Hydro-electric Power Commission of Ontario have just issued their new "Rules and Regulations" for inside electrical installations, including also rules on signalling systems, wireless telegraph apparatus, electric railway work, etc. It will be remembered that some time ago a preliminary copy of these rules appeared which met with considerable opposition. As a result the present rules are framed according to somewhat different standards and now correspond very closely, in the main, to the National Code. The Commission's rules, however, are a distinct advance at certain points over the National Code rules. The Ontario rules cover quite thoroughly the question of life hazards, not included in the National Code. The arrangement under the different headings is also much better. For example, in the National Code, the wiring requirements in connection with switches and cutouts are found in about thirty different places, whereas in the Ontario rules these are all compiled under one heading. The contents are properly indexed and it is now an easy matter to place one's finger on the particular item required. The Ontario rules also contain a certain amount of detail not found in the National Code.

The "rules and regulations" specify further that all materials, fittings, devices, etc., which have been formally approved, without question, by the Commission. The Commission, however, do not tie themselves by any hard and fast rule to the Underwriters' Laboratories approval, but will permit the use of any material where it is demonstrated to the satisfaction of the Commission that this material is up to the standard set by the Chicago Laboratories.

Another, and most important provision in connection with the new rules is that requiring the appointment of inspectors, by the corporation of any municipality, for the purpose of enforcing due observance of the regulations. It is understood to be the intention of the Commission to insist on properly qualified inspectors. Wherever possible, these inspectors will have no other duties, combining, rather, the work of two or three or more municipalities, so as to occupy their time fully. While the appointment of inspectors by the various municipalities is not intended to insinuate that there has been anything like a universal slackness in connection with the installation of wiring throughout Ontario, yet the fact that there are a number of installations which are recognized as unsafe has no doubt influenced the Commission to institute a proper system of inspection covering the whole province. It is quite within the range of possibility that the trouble in Oakville would have been averted under proper inspection even without the grounding of the service transformers, and the same is true of more than one other fatality and semi-fatility that we can recall during the last few years.

And no less important than the appointment of these inspectors is the system by which the inspectors shall be inspected and the work throughout the province standardized and maintained according to a proper ideal. This will be one of the most difficult matters in connection with the working out of the system and it will be an early move on the part of the Commission to establish an inspection department controlled by a suitable head, who will be responsible to the Commission direct and be in no way subservient to any other department. Such an arrangement will require a man who at the same time possesses accurate engineering knowledge, and is in touch with the practical requirements of the department, and who is beyond the reach of outside influences in the rigid interpretation and enforcement of the rules. It is only justice to the various interests concerned, both private and municipal, that a man of this type, as nearly as possible acceptable to all, and possessing the confidence of all, should be placed in charge and given a free hand.

The Oakville Accident

The unfortunate occurrence in Oakville which resulted in the death of two persons by electrocution is not surrounded by any mystery, as has been stated, but was satisfactorily, if not immediately, located by the engineers who were called in to make a report. The situation in the town of Oakville is as follows: power is supplied to the town by a private company, the Dominion Power & Transmission Company, and sold off their high voltage line to the municipality of Oakville. The municipality, on its part, transforms down to 1300 volts for a series street lighting system and to 2200 volts for a distribution net work for house lighting. The 2200 volt line is again reduced by pole-type transformers to 110 volts. It appears that at some time previous to the accident the 1300 volt line came, by some means, short circuited with the 2200 volt line. Also the 1300 volt line was shorted on to the 110 volt line at two points, these two points happening to be fed from different service transformers. In each case, therefore, the man who touched the wires completed the circuit from a 2200 volt line to ground. It was therefore of no significance that the street lights were on in one case and off in the other.

It is often difficult to lay one's finger on the particular defect in a system which is responsible for trouble, but in this case it is clear that if the secondaries of the service transformers had been grounded, the accidents could not have happened. The question of whether it is best to ground is one that has been freely discussed in the past few years, and different opinions have been held, but in later years engineers have come to look with disfavor on the system of installation found in Oakville. The practice of grounding the secondary transformers is now followed by the Toronto Electric Light Company, the Toronto Hydro-electric System, the Montreal L. H. & P. Company, the Electric Power Company's numerous systems in central Ontario, and many others.

The new regulation contained in the Hydro-electric Power Commission's rules, just issued, that everything below 150 volts must be grounded, is therefore most opportune. We understand also the National Code will, in its new edition to be out towards the end of the present year, contain the same requirements. This, with the added condition of rigid inspection which is included in the rules and regulations of the Ontario Commission, should make a repetition of the Oakville fatality a practical impossibility.

In other respects, too, the regulations of the National Code when not observed in Oakville in that the type of flexible cord used was not up to the standard specification. Neither was the portable lamp supplied with the necessary insulating handle. Had these regulations been observed, it is fairly certain that one at least of the fatalities would not have occurred.

Which all goes to show that it is not the lack of knowledge or rules or regulations in such matters, but that it is the carelessness or indifference which fails to observe the rules that causes most of the accidents due to the operations of electric currents.

The Toronto Hydro-electric Commission

It has been said that the Ontario Government's delay in filling the vacancy on the Toronto Hydro-electric Commission caused by Mr. Drayton's elevation to the Railway Board, is due to difficulty in locating a suitable man who will undertake to give the necessary thought and time to the office. No doubt this is correct for the very reason that any man who possesses the necessary qualifications to make him desirable in this position is, in the nature of things, so occupied with his own business that he cannot spare the time to any semi-philanthropic scheme that might easily occupy several hours of each day. Added to this, a position on the Board carries with it the inevitable exposure to criticism on the part of the public and the press, which cannot help, and generally renders much more difficult, the pursuit of any definite line of policy. And not only is this criticism misplaced, but it is at the same time very irritating to most good men. That the present chairman of the Board has given freely of his valuable time and has, almost without comment, run the gauntlet of much ill-advised and uncalled-for criticism, proves only Mr. Ellis' ideal of "public service," but does not suggest any argument, other than that contained in these two words, which is likely to appeal to the type of man we need to sit with Mr. Ellis on the Toronto Hydro-electric Board.

In justice to the present chairman, however, who cannot be expected to continually neglect his own private business and to carry the responsibility of the city's hydro-electric system alone, we believe the government would be well advised in making an early appointment to the vacant office. The name that appears to suggest itself most naturally is that of Mr. A. Claude Macdonell, M.P. for South Toronto. Mr. Macdonell is known as a man who "does things," and having become acquainted with the demands of public life, he has grown, we may suppose, somewhat impervious to the poisoned darts of public fault-finding. It is said that he would not accept the appointment but we are loath to believe that Mr. Macdonell's high sense of public duty would not be sufficient to lead him to accept any position where there is scope for the exercise of his executive ability in useful service to the city of Toronto.

With P. W. Ellis, A. C. Macdonell and Mayor Hocken composing the Hydro board, it is difficult to conceive of many serious errors or omissions in the carrying forward of the citizens' work. If Mayor Hocken really cannot spare the time, it is conceivable that Mr. J. W. Woods may be induced to step into the breach. Perhaps after all, the removal of the mayor from this Board would be best, for although Mr. Hocken would undoubtedly add much strength to the Commission, it is well to remember that Toronto is no longer a village and that the general organization of the city's business requires the undivided attention of even so capable a mayor as Toronto is at present blessed with. The removal of the mayor's name from the Board and the substitution of that of Mr. Woods would also give continuity to the work of the Commission.

It is understood that the Vancouver Public Service Corporation will shortly commence work on its project of generating steam heat and electric power from the refuse at the various city mills, for distribution throughout the city of Vancouver in accordance with an agreement with the city council, recently endorsed by the ratepayers.

Generating Power at the Mine

Mr. L. S. Cockburn, B.A.Sc., recently delivered an address before the Society of Engineers of Saskatchewan and the members of the Board of Trade at Regina, dealing with the production of power for lignite coal and its transimssion to Moose Jaw and Regina. Moose Jaw is situated 25 miles from the point in the coal fields at which it was proposed to install the plant, and Regina is 41 miles farther south. The estimates are figured on an initial generation of 6,000 kilowatts in a power house so designed as to allow of indefinite extension. The boiler plant estimated on would consist of nine boilers of approximately 1,000 h.p. each, at 150 lbs. pressure, which would drive four 1,500 kw. turbo-generators.

The cost of the generating plant is put at $470,000, made up as follows: buildings, $20,000; boiler plant, pipe and coal and ash handling equipment, $180,000; four turbo-generators with necessary step-up transformers and auxiliary equipment, $270,000.

Transmission at 44,000 volts is suggested and estimates are made on a single circuit wood pole line, a double circuit wood pole line and a metal tower line. These are estimated to cost respectively $127,540, $171,120 and $258,438, size No. 1 wire being used from the plant to Moose Jaw and size No. 4 wire from Moose Jaw to Regina.

The sub-stations are placed at $50,000 for Moose Jaw and $70,000 for Regina. The Moose Jaw equipment would consist of three 800 kw. transformers and a rotary converter of 500 kw. capacity. The Regina equipment would be four 900 kw. transformers and two rotary converters of 500 kw. each. This brings the total cost of $820,000 made up as follows: generating station, $470,000; transmission line, $171,120 (double circuit wooden pole line); sub-stations, $120,000; engineering and incidentals, $58,800. To this is added $25,000 for the cost of the coal mining equipment making a total of $845,000 for the investment.

The fixed charges are figured at $168,200, made up of $90,000 interest and sinking fund at $78,200 operating expenses. This figures out to 1.53c. per kw. hour on the combined consumption calculating a 25 per cent. load factor. Figures were given showing a reduction in rate per kw. hour to .66c. as the load factor gradually increased to 90 per cent.

International Electrotechnical Commission

The dates for the next Congress of the International Electrotechnical Commission, which is to be held in Berlin, Germany, have just been settled, the announcement now being made that the first meeting will open in that city on the 2nd of September next, and that the gatherings will continue for the balance of that week. This Commission is an international body engaged in the world-wide standardization of the fundamental units used in all electrical work, the terms employed to describe various types of machinery, the nomenclature and symbols current in electrical text books and other allied literature, and the methods of testing electrical apparatus, etc., a work always important, but more especially so in view of the enormous increase in the use of electric motors, lights, and devices, which has taken place in the last few years. There are about twenty member countries in the Commission, comprising practically all the European nations, besides for instance such widely scattered memberships as Japan, Brazil, and Mexico, in view of which it is apparent that the rulings of the Commission are the product of experience gained from almost every conceivable condition under which electrical apparatus can be manufactured and operated. Further, as the individual members are in the forefront of electrical work in their respective countries, the decisions of the Commission form the most complete and satisfactory international standards that can possibly be produced.

The Canadian and other National Committees have for some time had under consideration the rulings proposed by two important sub-committees, namely, on symbols and on rating, and the various amendments suggested by them were discussed very fully at the sub-committee meetings lately held in Zurich, Switzerland. One of the main questions raised regarding symbols was the selection of suitable characters to distinguish between vector and scalar quantities and between electric and magnetic quantities, a point on which there was a long discussion both in some of the National Committees and also at Zurich. The final decision, it has been pointed out, should take into consideration not only the technical aspects but also the very practical point as to what characters will be most readily available on a typewriter or type-setting machine. The report on the Rating of Electrical Apparatus will likely be amended in one or two interesting points; for instance, it is suggested that ultimate temperature, and not temperature rise, be standardized as the basis of rating, on the ground that it is really the former that governs the life of the apparatus which may be in question. Further, the term "cooling-air" is proposed as a substitute for the time-honored phrase "surrounding air," the change obviously being suggested with reference to the modern practice of forced ventilation. These proposed rulings, in their ultimately amended form, will go before the plenary meeting at Berlin for final and official ratification, besides which there are, of course, a number of other important recommendations to be considered.

The question of Canadian representation at the Berlin Congress is also one that has to be decided very shortly by the Canadian Committee, the matter being to a certain extent one of finances. Previous delegates have been Dr. L. A. Herdt, who attended the preliminary meeting in London in 1906, at which time the statutes of the Commission were drawn up; Mr. Ormond Higman, who went to the London Conference in 1908, and Prof. L. W. Gill, of Queen's University, who represented Canada at the 1911 Congress in Turin, Italy.

German Electro-Technical Industry

According to a report just issued by the German Union of Electro-Technical Manufacturers, the past year was a good one for the industry, the marked increase in the adoption of electricity for lighting and power purposes reflecting itself in increased turnover by most members of the union. Profits, however, chiefly owing to the advance in metal prices, were not always satisfactory. The union includes almost all the German electrical companies outside the A. E. G. and Siemens Schuckert groups. Makers of motors were well employed, but unfortunately it was only possible to obtain better prices for those of upward of 5 horse-power. The cable branch of the industry had little reason to complain, for owing to the efforts of the Cable Cartel prices were brought to profitable levels. Foreign competition was very keen. Prices of insulated wire, which were very unsatisfactory in 1911, were improved, producers coming to a price agreement. Toward the close of 1912 a price cartel was formed with regard to insulating tubing, the manufacture of which had become quite unprofitable. There was a slight improvement in arc lamp trade owing to the introduction of new and improved types, but the incandescent lamp trade left much to be desired. The German tax on lighting apparatus is seriously handicapping both the home and foreign trade. Owing to the customs practice in the United States and Canada of including the German lighting tax as part of the basic price on which to impose their own ad valorem import duty, it is now proving quite impossible to export German electric lamps to these markets.—Daily Consular and Trade Reports.

Electrical Contracts Let

At the annual meeting of the Western Canada Power Company, held in Montreal, Mr. C. H. Cahan, K.C., the president, stated that in addition to ordering two additional 13,000 horse power double Francis turbines from Escher, Wyss & Company, the directors had given a contract to the Canadian General Electric Company for two generators, and had ordered from the Canadian Westinghouse Company the switchboards and accessories to complete the power house to double its present capacity. Although under its contract, which was recently completed, the British Columbia Electric Railway Company, Limited, was not actually required to take electric power from the Western Canada Company before September 1st next, that company had already commenced to take 6,000 horse power.

Mr. Cahan added: "The establishment of grain elevators, flour mills and cement mills, together with the new steel works, which will soon be in operation in Vancouver, will ensure large increases in our sales of power, and we must now prepare for the large demand which these industries will certainly make upon us."

The following were elected directors of the company for the ensuing year: C. H. Cahan, A. R. Doble, T. J. Drummond, Wm. McNeil, Campbell Sweeney, A. H. B. MacKenzie, R. F. Hayward and DeForest Hicks. Mr. Cahan was subsequently re-elected president; Mr. T. J. Drummond, vice-president; and Mr. O. B. MacCallum, secretary-treasurer.

Underground Conduit in Montreal

Mr. G. M. Gest, of Montreal and New York, has been awarded the contract for constructing the first section of the underground conduit system as planned by the Montreal Electric Service Commission. There were four tenders submitted, and the Commission recommended that the tender of Mr. Gest, at $271,758, be accepted.

This will be one of the most complicated pieces of work ever undertaken, the construction being under the sidewalks on St. Catharine street, the most congested street in the city. Mr. Gest has agreed to complete the work in six months, while the next lowest tenderer asked twenty-four months.

The City of Montreal is fortunate in securing so favorable a tender from Mr. Gest, as his long experience in specializing in conduit work, together with his capable organization, is a guarantee of first-class construction and thorough satisfaction. We know of no one better qualified to lay out and build a conduit and distribution system than Mr. Gest, and his willingness to undertake the completion of this important work in six months' time speaks volumes for his organization.

65,000 h.p. for Laurentide Pulp

The Laurentide Pulp Company, are planning big extensions to their plant at Grand Mere, Que., at a cost of approximately $1,000,000 and one of the most interesting features from the viewpoint of electrical engineers will be the building of a large new power house capable of developing 65,000 h.p. Application has been made to the Department of Public Works for permission to construct a dam across the St. Maurice River at Grand Mere. In the official application permission is asked for the right to use all the water power of the river at Grand Mere, with the exception of such as may be used for the sluicing of logs over the proposed dam. The dam is to be a concrete structure with sluice gates and a spillway 1,900 feet long.

The power house will have eight main power units with space for two more units when required. It is understood that the application will come before the cabinet council in the course of a few days and will be granted. The enlargement to the plant of the Laurentide Pulp Company will mean permanent employment for a large staff of extra men when completed.

Economy Test of a 200 h.p. Robb Scotch Boiler

There was recently conducted a 12-hour test of a 200 h.p. Robb Scotch boiler, a modification of the standard Scotch internally fired type. It evaporated 11.8 pounds of water per pound of combustible giving a combined boiler and furnace efficiency of 73 per cent. and this in spite of the fact that the boiler carried an average of 22 per cent. overload. While possessing the features which make the Scotch marine boiler so satisfactory and efficient, this modification embodies a few changes to increase the circulation. A cylindrical baffle plate open at the bottom and extending about 1-3 the length of the tubes carries the water to the bottom of the boiler from which it rises between the furnace and amongst the tubes and again enters the smaller upper drum by means of a neck.

In this test a good grade of semi-bituminous coal was used which analyzed as follows: volatile matter, 18.78; fixed carbon, 75.62; ash, 5.60. The test was conducted with running start and stop.

Among the more important data may be mentioned an average flue temperature of 507°, a combined furnace and boiler efficiency of 73 per cent., and a percentage of 22.35 over builders rating. The escaping flue gases average 10.81 per cent. of CO_2 with only 0.32 per cent. of CO. It is estimated from the analysis of the flue gases that a little over 18 pounds of air was supplied to a pound of coal burned.

The following table gives the heat balances:

	B.t.u.		%
Heat usefully expended, per lb. dry coal ...	10,826.0	=	73.00
Heat lost in moisture in steam	27.5	=	0.18
Heat lost in evaporating moisture in coal ...	28.7	=	0.19
Heat lost in combustible in refuse	307.6	=	2.07
Heat lost in unconsumed gases	248.1	=	16.88
Heat lost in moisture formed by burning H in coal	499.2	=	3.37
Heat lost in escaping gases above temp. of steam	796.2	=	5.37
Heat lost in escaping gases below temp. of steam	1,440.3	=	9.72
Heat lost in radiation and unaccounted for .	657.4	=	4.42

While this test gives very satisfactory figures regarding this boiler, the figures might have been still better had it not been for the fact that the bridge wall was reduced as it was thought that the draft would be so restricted that the boiler could not carry the load of the mill. Cutting down the bridge wall nearly level with the grates resulted in a considerable loss of coal and coke into the combustion chamber. The amount of this loss was not determined, but is included in the "radiation and unaccounted for" losses which amounted to 4.42 per cent.

Fifth Hydro Report

The Hydro-electric Power Commission of Ontario has just issued the 5th annual report of its operations for the year ending October 31, 1912. Following so closely on the 1910 and 1911 reports, the 1912 issue comes somewhat as a surprise, and we are pleased to note the businesslike promptness which actuated the Commission to publish this report before all the matter contained in it should have become ancient history. The contents are classed under five headings of legal proceedings, transmission systems, operation of the systems, municipal work and hydraulic investigations. In addition to many interesting photographs a map of Ontario showing the operations in the Niagara district, the Severn district, the Morrisburg district and the Port Arthur district, outlines the work of the Commission to date.

Ties Used in 1912

Advance Government reports show that a total of 16,619,362 cross ties were purchased by Canadian steam and electric railway companies in 1912. This is an actual increase of 2,230,138 ties or 15.5 per cent. of the total number purchased in 1911. The total value of these ties at the point of purchase was $7,469,336 being an average of 45 cents per tie. The average price in 1911 was 39 cents and the increase of 6 cents in 1912 is due to the increases in the prices of Jack pine and cedar ties which were purchased in greatest quantities in 1912.

Jack pine still heads the list although fewer ties of this material were purchased than in the preceding year. The greatest increase in the use of any one kind of wood was in the case of Eastern cedar which moved up from fourth to second place on the list. The great variation in the use of this material from year to year is an indication of the uncertainty of the supply.

The use of Douglas fir and hemlock increased and these two kinds of wood retained their relative places on the list. One of the greatest decreases was in the use of tamarack which dropped from fifth to ninth place on the list. This is another wood of which the supply is uncertain.

The four hardwoods, oak, beech, maple and birch were all used in greatly increased quantities, indicating the general tendency of railways operating fast, heavy trains to reduce the use of cedar and other soft, weak woods, and to increase the use of hardwoods or chemically treated Southern hard pine. In all, nineteen different kinds of wood were used for cross-ties in 1912.

Table Showing Total Ties Used

	1911		1912	
Kind of Wood	Average value	Per cent.	Average value	Per cent.
Jack pine	.41	37.9	.46	28.8
Cedar	.40	10.0	.45	19.7
Douglas fir	.38	13.5	.30	13.1
Hemlock	.35	11.6	.38	11.7
Western larch	.43	8.3	.43	7.2
Oak	.81	1.0	.67	5.6
Hard pine	1.11	a	.66	4.0
Eastern spruce	.26	6.3	.39	3.4
Tamarack	.32	9.7	.53	2.6
Chestnut	.56	.5	.59	1.6
Beech	.21	a	.68	.6
Western cedar	.42	.4	.35	.5
Maple	.21	.1	.77	.3
White pine	.29	a	.35	.3
Birch	.21	.1	.60	.2
Red pine	.32	.5	.48	.2
Balsam fir	——	—	.13	.1
Western spruce	——	—	.58	a
Elm	.43	a	.47	a
Poplar	.27	a	——	——
Black ash	.43	a	——	——
Total	$.39	100.0	$.45	100.0

a = less than one-tenth of one per cent.

The steam railways in 1912 purchased a total of 16,136,600 ties, 97.1 per cent. of the total number purchased in Canada. These railways used all the Western larch, chestnut, beech, maple, birch, red pine and balsam ties.

The electric railways, using less than three per cent. of all the ties, purchased cedar in greater quantities than any other material. Ties used by these railways are not required to carry the heavy loads and endure the excessive rail cutting that is experienced on steam railway roadbeds. Oak and elm are the only hardwoods used by these railways, although imported hard pine is used to a slight extent. Durability in contact with the soil is of more importance for this purpose than strength or resistance to wear.

Ties Used by Electric Railways Alone

	1911		1912	
Kind of Wood	Average value	Per cent.	Average value	Per cent
Cedar	$.41	28.0	$ .55	33.0
Douglas fir	.20	55.0	.43	32.5
Hemlock	.37	2.7	.44	10.9
Tamarack	.18	4.0	.61	6.5
Jack pine	.47	3.7	.58	5.3
Western cedar	——	——	.51	5.2
Eastern spruce	.25	.9	.34	3.4
Western spruce	——	——	.58	1.7
Hard pine	——	——	.70	.9
Oak	.61	.9	.82	.6
White pine	.41	.4	2.12	a
Elm	——	——	1.74	a
Red pine	.47	3.7	——	——
Chestnut	.46	.2	——	——
Total	$.29	100.0	$.52	100.0

a = less than one-tenth of one per cent.

There is a noticeable increase in the use of chemically treated ties by Canadian railways. In 1911 only 206,209 ties or 1.4 per cent. of the total were treated chemically to prevent decay. In 1912 a total of 1,518,189 ties or 9.1 per cent. received chemical treatment. The Canadian railways are evidently taking advantage of the saving that can be accomplished by the use of preservative treatment of cross ties. The accompanying tables give, in detail, the percentages and prices of each kind of wood.

Horse Vehicles in Central-Station Service

During the year 1912 the Commonwealth Edison Company had 130 horses, 107 horse vehicles and 72 electric vehicles in service. Allowing a deduction of 6 per cent. in the number of wagons in service at a time because of repairs or of horses being shod, idle or sick, there remain 101 horse vehicles with which to average the expenses. These expenditures are grouped under the following heads:

Feeding, shoeing and veterinary service	$29,712
Labor in barns and repairs to buildings	20 176
Repairs on horse vehicles	11,088
Total for the year 1912	$60,976
Cost per horse vehicle per month	$50.31
Driver's salary	60.00
Supervision per vehicle per month	4.6
Rent of barn per vehicle per month	4.05
Municipal wheel tax per month	0.4
Interest at 5 per cent., depreciation at 10 per cent., taxes at 1.5 per cent., insurance at 1 per cent.	5.73
Total cost per month	$125.18
Average cost per day per horse vehicle in service, on the basis of 25.5 days a month	$4.91

Twenty of the seventy-two electric vehicles owned by this company are used in carrying supplies from warehouses to customers' premises. About thirteen cars are employed for making lamp renewals, and ten trucks are used for installing small overhead-line extensions which do not involve the setting of poles. The remaining vehicles are used for delivering meters, for underground-line work, installing signs and pulling cables through conduits by means of the vehicle motors.

In size the electric vehicles range from 700 lb. to 4,000 lb. in carrying capacity, the average being about 2,500 lb. As the average time that they have been in service is about twenty-six months, the owner figures that the maintenance charges have reached a value that can be regarded as fairly typical of the service.

The electric wagons used by the overhead department were designed to carry all of the tools and materials used for installing the customer's service wires. Compartments for holding the supplies are arranged so as to be readily accessible to the linemen. Above these compartments are racks for holding cross-arms. Hooks are arranged on both sides of the truck for supporting coils of ropes and extension ladders. There is no room on the truck for anything except what is absolutely required, thus preventing the accumulation of junk.

In addition to the seventy-two electric commercial vehicles mentioned, the Commonwealth Edison Company owns three large electric trucks capable of carrying 3.5, 5 and 6 tons each. The largest one is used for hauling coal and the other two are employed for carrying reels of cable. The results obtained with the electric vehicles have been so satisfactory that this company is contemplating placing in service thirty more, some of which have been ordered already.

Operating Expenses for Electric Vehicles

Operating, repair and other maintenance charges on the electric vehicles owned by the Commonwealth Edison Company for the year 1912 are tabulated below. The number of vehicles in service at a time is taken as forty-seven in averaging the operating expenses.

DATA ON COMMONWEALTH EDISON ELECTRIC VEHICLES

Expenses	Total 1912	Cost per Month per Vehicle in Service	Cost per Day per Vehicle in Service
Supplies	$2,938	$5.21	$0.20
Painting	901	1.60	0.06
Tire replacement	2,838	5.03	0.20
Battery repairs	4,858	8.61	0.34
General Repairs	11,574	20.52	0.81
Washing, placing wagons on charge and minor repairs	8,136	14.43	0.57
Maintenance of garage building, including rental	8,243	14.59	0.57
Total	$39,488	$69.99	$2.75
Operating and repairs as shown above	......	$69.99	$2.75
Energy, at 4 cents	......	17.68	0.69
Driver's salary	......	65.00	2.55
Supervision	......	4.72	0.19
Wheel tax and state license	......	2.50	0.10
Depreciation (total cost of wagon less original cost of tires and battery spread over eight years)	......	20.00	0.79
Interest, taxes and insurance	......	8.33	0.33
	......	$188.22	$7.40
Average miles per vehicle per month	749.		

Although the maintenance charges on electric vehicles are about 50 per cent. more than those on horse vehicles, this increased expense is more than offset by the saving in time in traveling from one job to another. A horse vehicle can cover about 15 miles a day in delivery work, while an electric vehicle averages about 29 miles a day on similar work. The saving may not be apparent here, but in case men who are paid 40 cents an hour are being transported to a job, any time saved represents a net profit.

Kent Electric Co.

The Kent Electric Company of Richibucto, N.B., commenced operations in 1905. The power station is in connection with the saw mill at that point and so the engine which supplied power to the mill during the day time is used to operate the generator at night. In July, 1911, this company was taken over by the Swedish Canadian Lumber Company, but operates still under the old name. This company is now supplying electric light for streets and interiors in both Richibucto and Rexton. The annual output is about 30,000 kw. hours, the generating equipment consisting of a 250 kw. a.c. Royal Electric generator, single-phase, 60-cycle, 2200 volts. Carbon lamps are used on the streets.

The manager of the company is Mr. O. W. Nordin, but the business is in charge of Mr. A. Kulinder, former manager of the company's mills in Rexton and Richibucto, but now assistant general manager of the company. The chief engineer and superintendent is Mr. Lester Brown who has been connected with the plant since its inception.

Protection for Electric Circuits

By Mr. W. G. Merowitz

Of the five general classes into which all electrical apparatus may be divided, namely, generation, transformation, utilization, control and protection, the latter class, that of protective apparatus, appeals to the writer as being the most important. For the designer of the present day has not given to us apparatus which will be immune from destruction, due to a dead short circuit or other abnormal condition of the circuit, without a protective device.

Protective devices may be classed as, circuit breakers, oil switches, relays and systems which include relays, switches and circuit breakers. Every protective device of the circuit breaker or oil switch class must be capable of performing two functions; (1) that of carrying the current continuously without undue heating and (2) that of satisfactorily interrupting the energy which is in the circuit at time of abnormal conditions. Contrary to the general impression regarding protective devices, their main use is not to open the circuit but to keep the circuit closed, except in such cases where opening is absolutely necessary in order to prevent immediate destruction of the protective apparatus. The fallacy that the function of a protective device is to open the circuit on any and all occasions is the basis of a somewhat false design and poor operation with some types of devices now on the market.

If electric generating or power machinery would stand overloads and short-circuits, there would be no necessity for protective devices. Central stations are in business to sell current and anything that tends to interrupt the continuity of service tends to not only cut the earnings of the company but also to irritate the customer. It is only because we are called upon to handle enormous energies, which produce disastrous results on short-circuits or other abnormal conditions, that protective devices are needed. Since the protective device is the link between the various classes of apparatus, generating, transforming, utilizing and controlling electricity, it follows that the successful operation of the station, depends upon the successful operation of the protective device.

Considering now the first function, which every device for protection must fulfil, that of carrying current continuously. All devices, whether carbon circuit breakers or oil switches, must fulfil this function, regardless, whether it is used to protect a one horse-power motor or a 20,000 kw. generator. It is always, in series with the apparatus it protects, and must therefore carry the same current continuously. In this respect, there should be a broad line drawn between protective devices and controlling devices, as controlling devices are only used during the starting period and hence, carry the current for only a short time.

Of course, the most satisfactory joint for carrying the current continuously is a well soldered joint, and this is followed by bolted and by laminated joints. Blade contacts, clip contacts and butt contacts are also used. As it is necessary to use a joint which can be easily closed and opened, it is readily seen that the soldered or bolted joints cannot be used and the laminated joint comes next in efficiency as a current-carrying member. The laminated brush posesses the advantages of not only being able to make and maintain a good contact, but can be easily removed from the contact to open the circuit. When the laminated brush is correctly made and used it is the best current-carrying member employed for either carbon break circuit breakers or oil switches. Whatever kind of contact is used, it should be of such design as to be able to efficiently take care of the full load current of the switch, with a rise of not more than 30° C. A higher rise than this would heat the oil and experiments show that heated oil is not so effective as cool oil, in quenching the arc.

And now, considering the second function which a protective device must fulfil, that of satisfactorily interrupting the energy at abnormal times. It seems pretty well proven that, for direct current circuits, carbon-break circuit breakers, of ample size are entirely satisfactory. If the resistance of the carbons is low at the instant of the break (not when the breaker is closed) and if the break is wide enough such a circuit breaker when properly mounted will open any short circuit which it may be called upon to handle. For a.c. circuits, however, a carbon-break circuit breaker is not so satisfactory, even on low voltage installations, as long flaring arcs, due to the inductive discharge of the circuit, not only burn the contacts but create a disastrous rise of voltage, which at times will be large enough to break down the insulation and start a fire. Oil switches, on the other hand, break the arc in a bath of oil and when these switches are provided with the proper form of contact for carrying the current, there is no excuse for using carbon-break breakers for alternating current, whether the voltage is 110,000 or 110; the oil switch being in most cases cheaper and in all cases more satisfactory.

Other things being equal, the oil switch which has the strongest mechanical structure, the strongest oil tank and the greatest head of oil over the break, will open the most energy. These points can easily be determined by inspection of the switch. It is not always the best policy to purchase circuit-breaking devices which can be depended upon to break extremely heavy short circuits, as the cost of real estate in some cases would render such an installation prohibitive and as the possibility of these extremely heavy short circuits may be exceedingly remote. But, nowhere is economy so unjustly exercised as when applied to the purchasing of protective devices and in no other class of apparatus should price be given as little consideration. The price of even the most expensive and best of these devices is almost nothing compared with the cost of apparatus which they protect and a few dollars saved on these devices may not only wreck the station apparatus but throw an entire section into darkness.

Relays are used to control the action of various kinds of oil switches and circuit breakers. The function of relays, is to cause the switch to open at any pre-determined point or condition of the circuit. The relay should be selected, not with the view of protecting apparatus, but of maintaining the service and that the circuit may only be opened when it was absolutely necesary to do so in order to prevent the apparatus from being destroyed and the line from being shut down altogether.

Synchronizing Force in Hunting

By Dr. Steinmetz before A.I.E.E.

If two synchronous machines, such as converters, are connected together slightly out of step, or are thrown somewhat out of step by some other means, the machine in which the rotor is ahead of the position of mean rotation (i.e., the "leading machine") gives more power and so slows down, while the "lagging machine" gives less power and so speeds up, and the machines thus come nearer together.

However, when they are in step, the machine which was formerly leading, being slower in speed, still loses, and thereby drops behind; while the machine which was formerly lagging gains due to its higher speed, and thus runs ahead, and the machines again pull apart, this time in the opposite direction. This goes on until the increased load on the leading machine retards it and once more causes it to drop back; while the decrease of load on the lagging machine causes it to speed up and gain. In this manner by a number of successive oscillations the machines settle down into step. If there were no losses, at every swing the machines would pull apart again as much as they were apart in the preceding swing; but, owing to the energy losses caused by the oscillations, the swings decrease the more as more energy is dissipated by them, and the oscillation thus is damped out. This is not hunting, but the natural and inherent adjustment into step by a decaying oscillation.

The pulling together of synchronous machines is the result of the increase of load on the leading machine, which retards it, and the decrease of load on the lagging machine, which accelerates it; and the change of load with the change of the relative position of the machines thus is called their "synchronizing power." That is, we may consider—and if the machines are running at no load, this is actually the case—that the leading machine transmits power to the lagging machine, and that hence an interchange of power occurs. If there were no interchange of power with the relative position—that is to say, if the running ahead of a machine would not put any load on it, and inversely—there would be nothing to stop the machines from drifting out of step with each other. If the running ahead of a machine would decrease the load on it—as is the case in series connections of two alternators—it would continue to run ahead with increasing force, i.e., the conditions of "instepness" would be unstable, and equilibrium and synchronous operation impracticable.

Result of Position Displacement

The synchronizing power, i.e., the power exerted by one machine upon the other, is the result of a position displacement of the machines, and is thus the cause of the possibility of parallel operation. The synchronizing power is, approximately, proportional to the displacement in position; if the two machines are thrown out of step by twice the angle (i.e., the one pushed ahead, and the other back, from its mean position by twice the position angle) obviously the exchange of current, and thus of power, is approximately twice as before.

Synchronizing force, i.e., the force with which the leading machine is pushed back and the lagging machine forward, thus is (approximately) proportional to the amount of lead or lag of the respective machines; and, as a result, the force with which a machine runs ahead, is held back and finally stopped, is the same as the force with which it moves back into step again and then out of step in the opposite direction. This, however, is the case only if there are no losses and no lag of the synchronizing force behind the position displacement.

The result of losses is that the machines are held back from going apart with greater force than they are pushed together again, and thus on the next swing go apart less, i,e., gradually settle into step.

The result of a lag of synchronizing force behind the position displacement is that, when the displacement increases (i.e., the machines pull apart), the opposing synchronizing force is less than it is when the machines come together again; and the machines thus are pushed together at an increased energy, and on the next swing go apart further. In other words, the result of a lag of the synchronizing force behind the position displacement is an increase of the successive swings; a cumulative oscillation, or hunting. Thus hunting is not an incident of synchronizing force or insufficiency of it; but is the result of a lag of the synchronizing force behind the displacement in position which produces the synchronizing force, and is thus a true hysteresis effect, i.e., a "lagging." If there is no lag of the synchronizing force, there can be no cumulative oscillation, i.e., no hunting; but, since energy losses must always be present, the machines must steady down to rest.

The relation between mechanical momentum and magnetic forces, the frequency and intensity of energy impulse, etc., have no direct bearing on the phenomenon of hunting, however important they may be; but merely determine the frequency of the synchronizing oscillation, and thus of the hunting, if it can occur, and to some extent the rapidity of its increase.

If a lag of the synchronizing force is present—and some lag almost always exists—hunting would occur if the cumulative energy resulting from this lag is greater than the energy losses due to the oscillation. If the energy losses are greater, hunting does not occur; but the energy losses decrease the oscillation more rapidly than the lag of the synchronizing force increases it.

Practically all anti-hunting devices—i.e., devices which dampen oscillation by energy dissipation, such as short-circuit conductors around the poles, between the poles, a complete squirrel cage winding, etc.—also cause more or less lag of the synchronizing force, and thereby increase the hunting energy. This explains why an anti-hunting device may in one case stop hunting; and the same, or similar device, in another case make hunting worse; if the increase of energy losses due to the device is greater than the increase of lag of the synchronizing force, it improves the operation; otherwise it makes hunting worse.

The foremost problem in the design of anti-hunting devices is to reduce to a minimum the lag of the synchronizing force caused by them. They usually operate by currents produced in them by e.m.f's. induced by the position oscillation. Since, owing to inductance, the currents lag behind the induced e.m.f's., this gives an unavoidable lag of the synchronizing force; and the more non-inductive the anti-hunting winding is made, the more effective it thus becomes. Therefore, while a conducting collar around the face of the pole close to the armature may stop hunting, the same short-circuit around the field pole at a distance from the armature may make hunting worse, owing to the greater self-inductive lag of the currents induced in it.

The Cause of Hunting

Hunting then is the phenomenon resulting from the lag of the synchronizing force behind its cause, the position displacement; and is a general phenomenon, which can be observed in all oscillatory phenomena where a lag of the effect occurs behind its cause.

Thus the vibration of a belt may become a mechanical hunting, increasing an amplitude until the belt is thrown off. The pulley is double cone shaped; so that the belt, when running towards one side, grips on one side of the cone, and therefore rolls up on the cone towards the middle of the pulley. There it runs over on the other side, grips there, and rolls back to the first side; and so see-saws between the two sides of the pulley. If now the conditions are such that the belt runs beyond the middle of the pulley, before it grips on the other side, it comes back with increased force, i.e., the vibration increases in amplitude, in true mechanical hunting. Here also the observation can often be made that the operation is steady at heavy load, where the energy losses (slippage and stretching of the belt in this case) dampen the hunting; while at light load the oscillations begin, just as is often observed in the case of synchronous machines.

One of the most important oscillations with which electrical engineering has to deal, is the electromagnetic oscillations of distributed capacity and inductance—electric waves, impulses and other transients. When dealing with such waves in overhead transmission lines below the corona voltage, i.e., in magnetic and dielectric fields which are proportional to the current and the voltage respectively, no hunting can occur. As soon, however, as this proportionately ceases, and a lag makes its appearance, such as the lag of the magnetic field behind the current in magnetic materials, the lag of the arc voltage behind the arc current, etc., true hunting may occur, if the energy dissipation (i.e., the ohmic resistance) is sufficiently low; and in such case, then, as oscillations in the high potential windings of alternating current transformers, in the phenomena of arcing grounds, etc., electromagnetic hunting—analogous to the electromechanical hunting of the synchronous machine—can occur and has been observed and studied.

Long Distance Telegraphing

As recently stated in the Electrical News, an invention has been perfected by Mr. Jno. Gott, of London, Eng., consulting engineer to the Commercial Cable Company, which in turn is controlled by the Mackay Companies, by which it was possible to telegraph between London, Eng., and San Francisco, and a few days later between London, Eng., and Vancouver, B.C., without the necessity of relaying. A brief description of the invention which has had such a revolutionizing effect on the transmission of long distance messages by telegraph is given herewith.

The purpose of the invention is to apply the international Morse code to the transmission of messages over long submarine cables, in place of the code now used, whereby uniformity of working with land lines and other connections may be established.

It is well known that reversed currents sent rapidly through a long submarine cable are the most effective in definition as received at the distant end of the cable—each following current having the effect of neutralizing the preceding one. In Mr. Gott's invention every unit of each letter is formed by a reversed current, so that in no case during transmission does a current of the same polarity follow.

At the receiving end of the cable these reversed units of letters are transformed in a simple manner so that the alphabet comes out in Morse characters as if received through a short land line and are therefore easy to read and transcribe.

To obtain the reversal of polarity for each unit of a letter with absolute uniformity and certainty Mr. Gott makes use of the discharge of current from the cable itself, which, having considerable energy, is able to act upon a polarized relay and cause the desired change of direction for the following signal. The direction of the discharge is a factor of the polarity of the charge, and changes in accordance therewith, so that the reversals produced by this action on the polarized relay follow in sequence with infallible regularity. Another method of effecting the reversal of the polarized relay consists of a transformer provided with primary and secondary coils, the primary being placed in the earth circuit of the split or double battery. Currents are induced in the secondary, which is connected to and actuates the polarized relay. The induced currents in the secondary coil are reversed according to the polarity of the last current sent into the cable and these reversals take place in regular sequence, assuring that no two successive currents are sent of the same polarity. One advantage of this last method is that on making contact with the key to charge the cable the battery contact in the relay is reinforced at the moment the key is depressed, thus assuring perfect transmission. This is brought about by the action of the secondary coil. The sending of messages through the cable is effected by the working of a single Morse key of the usual type so that the operator's mode of manipulation is exactly the same as if he were sending into any ordinary line.

Where it is desired to send messages automatically the message is prepared on a perforated slip and the Wheatstone transmitter takes the place of the key, the reversing polarized relay being connected in circuit as for hand keying with the ordinary and well-known Wheatstone transmitter. The two upper contacts of the vibrating contact arm are used to take the place of the key. So also, where the system is applied for translation from a land line or short connecting cable, the usual receiving relay is connected to the reversing polarized relay in the manner described for the hand key and the received Morse signals are translated into the cable in the form of a "reversed current alphabet" or alternating current alphabet devised by Mr. Gott. Also the relay referred to may work a sounder-relay in a local circuit, which being connected in place of the single Morse key, translates the signals for the short connecting lines or cables into the main cable.

It remains now to point out how the Morse code, which is sent through the cable in the form of reversals for each unit of a letter, is retransformed into the common Morse code. In all systems of relay repeaters on long cables hitherto used the contact arm when at rest occupies a neutral position (known as no man's land) between two contact plates which are connected to the local battery intended to actuate local instruments for repeating the signals either into another cable or to record the received signals. If we connect the two contact plates together it follows that the movable contact-making tongue will record signals made on either side, and these signals will appear on the local apparatus as if made continuously on one contact. For example, two reversals will appear as four dots (the letter "h" in Morse), and we shall have all the reversed signals received through the cable transformed into the well known Morse characters. These may be read by sound or printed on a Morse slip and similarly they may be repeated automatically to another distant station in the Morse characters. It follows from these observations that the cable relay, with its contact tongue and neutral center, will faithfully transmit the reversed Morse code into another cable in the form received, and that the final transformation takes place at the terminal station of the main cables where the message is either transcribed for delivery or repeated inland.

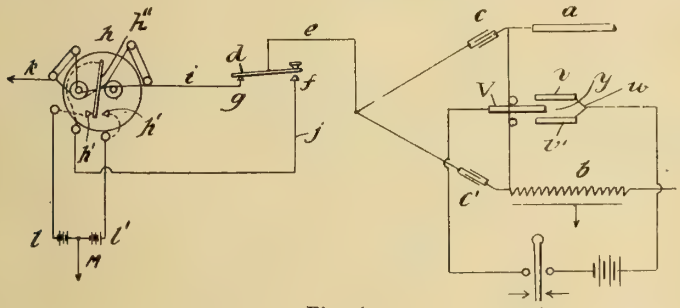


Fig. 1.

In the diagram Fig. 1 a designates a cable; b the artificial cables used for duplex; c, c′ the sending condensers; e the wire connecting the key d to the apex of the bridge arms; f the front contact of the key; and g the back contact thereof. The front contact f is connected to the tongue or vibrating arm h″ of a polarized relay h by wire j; and the back contact is connected to the coils of the relay h by wire i. When the key is depressed the battery is connected to the cable, and when the key is open and in engagement with the back contact the cable discharges through the relay coils and to earth at k. To the two stops h′ h′ of the relay h are connected the opposite poles of a spilt battery l l′, the center part of battery being grounded at M. The tongue or vibrating arm h″ of the polarized relay is adapted, as is usual, to make contact with either of the stops h′ h′.

When the key d is depressed the battery l or l′ is connected to the cable through the wires j and e. When the key is opened the cable discharges through the polarized relay to earth and in doing so causes the tongue of the relay to be thrown to either contact h′ h′ according to the polarity of the discharge. As this polarity is always opposite to the polarity of the preceding discharge it is manifest that the tongue or arm h″ will be thrown from one contact h′ to the other at the end of each key operation, so that the battery to the line will be reversed each time the key is opened and the cable discharged. The result of this is that the current impulse sent to the line at each key operation will be opposite in polarity to the previously sent current impulse. It is therefore evident that in operating the key for sending Morse code signals each signal unit impulse will be opposite in polarity to the preceding signal unit impulse and no two succeeding signal unit impulses will be of the same polarity.

Owing to the considerable energy of the discharge from the cable and condensers (not heretofore utilized) the resistance of the coils of the polarized relay may be negligible and still afford ample opportunity for the discharge to be effective for good signaling.

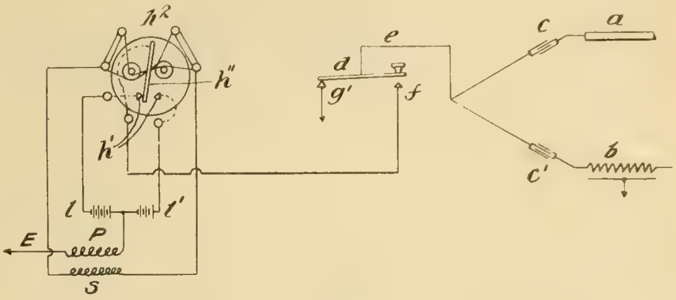


Fig. 2.

Referring to the construction diagrammatically illustrated in Fig. 2, the back contact g′ of the sending key d is connected to earth and the discharge from the cable and condensers is directed to earth through said contact when the key is open. The reversal of the polarized relay h^2 is brought about by the split battery making earth at E through the primary coil P of a transformer, the secondary coil S being connected to the relay coils. The opposite poles of the two portions of the split battery are connected to the contacts h′ h′ of the polarized relay in the same manner as shown in Fig. 1, and the front contact of the key is electrically connected to the movable tongue or vibrating arm h″ of the polarized relay. It is manifest that when the key is depressed a current will be induced in the secondary coil of the transformer, which current will firmly hold the tongue of the polarized relay against one of its stops. It is also evident that when the key is opened a reversal of current in the secondary coil will take place and the vibrating tongue or arm will then be thrown against the other stop of the polarized relay, thereby reversing the polarity of the current to the front stop f, and consequently to the line, when the key is again depressed or closed. The same cycle of operations follows each depression and raising of the sending key.

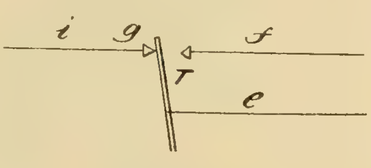


Fig. 3.

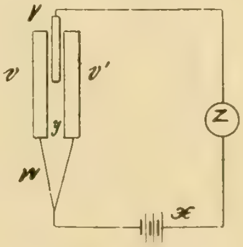


Fig. 4

Fig. 3 simply illustrates how the tongue T of a relay connected to a land line or short cable takes the place of the key either in Fig. 1 or Fig. 2. It also illustrates how the rocking contact bar of a Wheatstone transmitter is connected in place of the key to send automatically into the cable, the upper two contacts of the transmitter only being used.

Fig. 4 represents the apparatus used at the receiving of terminal end of the cable. The two metal plates v and v′ are separated by an insulator y. The contact making tongue V is actuated by an attachment to the signal coil of a recorder, which coil is in circuit with the cable. Arriving signals move this tongue from zero to v or v′ according to the polarity of the arriving current. For the purpose of this invention the two metal plates are conected together by the wires at W and are in circuit with the local battery x, etc. The instrument at Z may be a Morse recording instrument, a sounder or relay or other instrument. It will be clearly seen that rapid reversals will be indicated by the sounder, for example, as dots or dashes, as if made on one contact only, as in ordinary Morse working.

B. C. Electrical Development

The installation of a series tungsten lighting system, consisting of 225 lamps, was recently completed in the municipality of Oak Bay, adjoining the city of Victoria, and anticipations were more than realized by the success of the first test. The system is highly efficient, and can be added to from time to time as the development of the district warrants. Esquimalt municipality will not be long behind its older neighbor in the matter of a street lighting system, as it has now on order a similar installation with the B. C. Electric Company, which put in that of Oak Bay. The Esquimalt installation is a series tungsten system consisting of apparatus having a capacity of 275 80-watt lamps, of which 130 will be installed immediately, and the balance from time to time as required. Current will be supplied to both municipalities by the company. The work in Oak Bay district was under the direct supervision of Mr. S. J. Halls, manager of the light and power department of the B. C. E. R. Company, who will also give similar personal supervision to the system to be installed at Esquimalt.

Social Gatherings

The employees of the British Columbia Electric Railway Company take great interest in the development of the social side of the company life, the management of the concern asisting in this movement as it has been found that a social gathering of the staff works to the best interest of the company's service. During the past month the B. C. Electric Social Club held a ladies' night and conversazione in its Vancouver quarters. It was attended by over 200 members of the club and their lady friends. General manager Sperling and all the chief officials of the company were present and took an active part in the programme. At Victoria the office staff gave a dance at the Alexandra Club which was attended by over 200 members of the staff and their friends. In the Delta district the employees of the company organized and gave a dance at Ladner which was the chief social event of the season in the district. The management of the company is now paying attention to providing for the pleasure of its employees during the outdoor season. The company recently acquired 10 acres of land in the suburbs of Vancouver and plans to utilize this tract, for the present, as recreation grounds for its employees. During the present season one acre will be cleared and lawn tennis courts laid out, as well as a suitable club house erected.

Inspecting Coquitlam Work

Mr. J. R. Freeman, the engineer who is representing the Dominion Government in connection with the erection of the great dam at the outlet of Lake Coquitlam by the British Columbia Electric Railway Company, recently made an inspection of the work. While on the Pacific coast he addressed a public meeting at New Westminster concerning the dam. Press reports on this address quote Mr. Freeman as saying that Mr. G. R. G. Conway, chief engineer of the B. C. E. R. had co-operated with him concerning the construction of the dam in every possible way and, as a result, the dam would be one of the safest in the world. The water supply of New Westminster is taken from Lake Coquitlam and Mr. Freeman said that the provisions made by the company to preserve the purity of this supply entailed an expenditure of nearly $1,000,000, this amount covering clearing about the lake, erection of new water works intake, etc.

The great dam of the B. C. Electric at Lake Coquitlam will probably be completed in June, this being in advance of expectations. It will be 98 feet high, 600 feet wide at the base, 850 feet long and 40 feet wide on the crest. In the construction 1,055,000 cubic yards of material will be handled. The storage capacity of the dam will be 7,404,000,000 cubic feet, giving a reserve supply during the dry season of over 53,700,000 kw.h. of electric energy.

Will Erect Three More Barns

The British Columbia Electric Railway Company has announced plans for the erection of three car barns, these being extensions of its present buildings of the class in Vancouver, New Westminster and North Vancouver.

The Vancouver car barns will be 400 feet in length, 52 feet wide and accommodation for forty cars on the four tracks which will be provided. The location is along the Lulu Island Railway line and the barn will serve both its interurban division and several branches of the Vancouver city lines. Tracks will be laid from the Kitsilano line and also from the Fourth avenue line entering the barns from opposite sides. The building will have a concrete foundation and will be constructed of wooden frame covered with corrugated iron. At the present time a small barn is located at the point and is equipped with shops for emergency repairs. The company's plans call for a duplication of the new barn on a location immediately to the east, in the near future.

The new barns at New Westminster are located on 12th street and will be 240 by 104 feet in size. Eight tracks will be provided into these barns, which will accommodate both the cars of the New Westminster city line and the interurban branches of the company's service. This structure will also have a concrete foundation with building of corrugated iron.

The North Vancouver car barn will have a concrete foundation, steel frame and covered with corrugated iron. This barn will not be as large as the Vancouver or New Westminster barns, but will amply provide for the accommodation of the North Vancouver cars for some time to come.

Burnaby Grants Franchise

On April 26th the electors of Burnaby municipality granted the British Columbia Electric Railway Company a franchise covering tram transportation for a period of 36½ years. The vote on the measure was 713 for and 299 against, thus giving a good majority over the requisite three-fifths. The immediate demands of the franchise are that the company shall construct a line two miles in length on Hastings street east, this being an extension of its Vancouver line. Another line, one mile in length, is to be constructed on the North Road as soon as the arrangements are made for the high level bridge over the Brunette River, this line being an extension of the New Westminster lines of the company.

The B. C. E. R. Company has announced its intention of building a large repair shop on D.L. 118, Burnaby Municipality, just outside the city of Vancouver. The Westinghouse, Church, Kerr Company of New York, have been engaged as consulting engineers for this plant and their staff is now engaged in preparing plans. It is the company's intention to make these shops up-to-date in every particular, the idea being that this plant shall do all the heavier repair work for all lines operating on the southern mainland of British Columbia. The shops will be called the Horne-

Payne repair shops in honor of the chairman of the board of directors of the company, Mr. R. M. Horne-Payne.

The B. C. E. R. Company has offered to construct a four-mile line across West Vancouver municipality, this being an extension of the company's North Vancouver lines. West Vancouver was recently created as a separate district and the B. C. E. R. has rights in the section by reason of a franchise covering the old municipality at North Vancouver. As West Vancouver is but sparsely settled, the company's offer to build the line demands that a guarantee be given as to operating expenses other than interest on invested capital, The annual cost of operating an hourly service over the line is placed at $10,000 per year. The question is now under negotiation between the company and the municipal authorities.

The traffic department of the British Columbia Electric Railway Company has directed its conductors to strictly enforce its established rule with reference to the carriage of dags on the cars of the city lines. This rule provides that dogs will be carried on the cars only when in the lap or arms of the owner and then controlled so as not to annoy possengers. This rule has been in existence for some time but has not been strictly enforced. As a result, a dog fight took place in the aisle of a crowded car recently, the occupants becoming greatly frightened. The company considered the report of this instance in connection with other complaints concerning dogs soiling the clothing of passengers, etc., and decided that this rule should hereafter be strictly enforced.

New Type of Mine Trolley

As a result of the demand for a mine trolley differing from the standard lines, a new type, as shown in the accompanying illustrations, has recently been placed on the market by the Westinghouse Company. This particular trolley has several distinct advantages over existing types, three very important features being as follows:—

(1) The variation in contact pressure for different trolley wire heights is much less than that obtained by a standard single pole trolley.

(2) The short length of the trolley pole permits turning around in narrow passages.

(3) Trolley does not interfere with high trailing cars on sections where trolley wire is low.

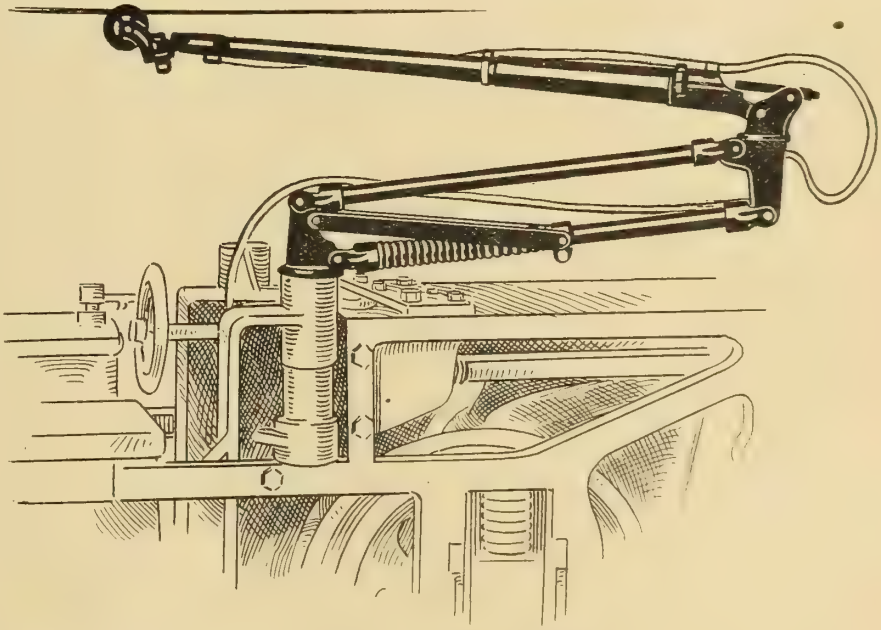
The design of the trolley is such that there is very little variation in the contact pressure when traversing sections of mines where the trolley wire is suspended at different heights. When the wire is at a height of five feet from the top of the rail, the trolley wheel pressure is approximately twenty-six pounds, while at a height of eleven feet it is about eighteen pounds. This shows a variation of eight pounds through a range of six feet, which is much less than can be obtained by a single pole trolley. With the standard single pole trolley, where the wire hangs low and extreme contact pressure is exerted, the pole is often damaged when the wheel leaves the wire and strikes a roof or other obstruction. The new type trolley under these conditions, owing to the slight variation in pressure throughout the wide range in height, will be less liable to danger of breakage. This slight variation also makes it unnecessary to resort to the heavy pressure for low trolley wires, with the result that the wear at the wheel and harp will be materially less than that caused by the single pole trolley.

In coal mines where the condition of the roof or overhanging rock is such that narrow entries are necessary, it is often impossible to run one of the longer single pole trolleys; whereas this new type trolley can be turned around in passages from four to six feet in width, with the socket located approximately in the center of the locomotive.

Where fairly high cars are used and a wide variation in the height of the trolley wire occurs, trouble is often encountered with the single pole trolley striking the car when the trolley wire is low, owing to the projection of the wheel over the car. The new trolley is designed especially to overcome this objection, as the entire operation of the trolley can be kept within a radius of four to six feet from the vertical line through the trolley socket. If the trolley wire changes in height and position over the track during the run, as is often the case on surface haulage, particularly in iron and copper mines, the trolley wheel can be made to follow the wire throughout a six-foot vertical change and a wide horizontal range without stopping the locomotive.

When the locomotive is used for gathering purposes, and where two single pole trolleys are ordinarily required, one on each side of the locomotive, this trolley can be used with the trolley socket located near the center of the locomotive toward the front end; the upper pole can be swung to operate satisfactorily on either side of the locomotive, whether the trolley wire be on the crosscut side of the entry or on the room side.

The trolley is designed to operate on a wire having a range in height of from 5 to 11 feet above the top of the rail; it being assumed that the locomotive trolley socket is about three feet above the rail. The trolley will operate successfully where the trolley wire may have a variation in its location from the center of the track on which the locomotive is running to 4 feet to the right or left, without change of location on the locomotive itself.



New type of Mine Trolley

The trolley consists of two members which operate in sockets. By means of a latch or pin at the lower socket, the lower member can be adjusted vertically and kept in a rigid position, and further, can be swung horizontally and fastened in any definite position required. Further, it can be used on locomotives now in service.

Adding Profitable Summer Load

The growth of the central station industry resulting from the employment of more scientific methods of management has been to a very large extent due to the attention that is now given to the improvement of the load-factors. Many central station managers who do not keep actual figures of the operation of their power plant would be surprised at the exceedingly small percentage their actual receipts are of the total receipts their plant might bring in if they were operating at full capacity. In many cases this is less than 25 per cent. and often gets down to 10 or even 5 per cent.

It is only the exceptional station that is so fortunately situated as to have a large proportion of its output used for power purposes, which results in a comparatively high load-factor, but in the average station where current is used largely for residence and commercial lighting, conditions are quite otherwise. Of the two lighting loads mentioned residence lighting generally has a better load-factor than commercial lighting alone, since offices and stores in general use current for a shorter period each day than do the residences. It therefore becomes the necessary duty of all central station managers to be on the look out for new methods by which the excess capacity of their plants can be put to a revenue producing use. In almost every case where the load can be increased the income is clear profit from the fact that this extra load can be taken care of without additional equipment or additional expense of any kind.

These remarks are specially applicable during the spring and summer months when the lighting load is much smaller and it is fortunate that this is the time of year at which many current consuming devices now on the market, are easy of introduction into the consumers' homes. There are a number of useful and popular, and indeed almost necessary devices, which on account of their convenience and economy of operation, consuming only a small amount of current, can be disposed of to the average consumer with comparative ease and are a decided factor in the revenue producing characteristics of any central station plant. These include the electric washer, vacuum cleaners of many sorts, motor-driven sewing machines, ironing machines, pumps, vibrators, polishers, percolators, toasters, water heaters, etc. A small general utility motor can often be installed for the consumer in his work-shop or for different purposes in the garage. Some of these articles have been considered luxuries, but in the present age any luxury which adds to a consumer's capacity for enjoyment or permits him to spend his hours of recreation in such a way that he is better fitted for his day's work, can no longer be considered anything but a necessity.

Electric Iron Comes First

As a revenue producer as well as a work saver the electric iron probably takes first place, the low first cost making it somewhat easier to introduce into the home. Since it is rugged in construction it can be placed on trial without fear of damage, and having once been installed it is a rare case that these are thrown back on the hands of the dealer. In many families, during the summer months at least, there is more current used for ironing than for lighting. Even in the smaller municipalities where the plant may not be operating throughout the day, the added convenience of the electric iron may easily be shown to be sufficient to justify householders in doing their ironing during the early evening hours when the current is first turned on. Or an arrangement might be made with the users of electric irons that the current be turned on for a certain definite period once or twice a week during part of the day, such as Tuesday morning from 9 to 11.

In the introduction of current consuming devices at this season of the year special stress should be laid, of course, upon those articles which are conducive to the comfort and convenience of the consumer in hot weather. Aside from electric irons, fans and ventilating apparatus will quickly arouse the interest of the average housewife or office man. Here again as fans are of rugged construction these may be put in on approbation and with a temperature ranging anywhere between 85 and 105 it is pretty safe to conclude that the average householder or office man will think twice before he sees his cooling devices removed. It is not only the comfort of the electric fan but, even more than this, the sanitary conditions surrounding its use which make it possible for those who come under its influence to do more and better work in the same time. Of course, electric fans cannot be sold in cold weather and the manager should be ready for the first oppressively hot day and should reap his harvest before it is over-ripe.

And here too it may be well to note again that a satisfied customer is often the best salesman a dealer can have. By making an occasional inspection of the electrical equipment installed or by, each season, taking the precaution of having the irons, fan motors or other equipment overhauled, satisfied, enthusiastic users are the result, at small expense to the dealer.

The Electric Cooker

Another line of domestic equipment which is coming rapidly into use and for which there is undoubtedly a very large field is the electric fireless cooker. Electric cooking in the past, while of admitted convenience has scarcely been attempted in competition with coal or gas on a basis of dollars or cents, but at the present time there is more than one make of apparatus which, in addition to the comfort and convenience resulting from its use can, under average conditions of current cost, compete in operating cost with coal or gas. This is partly the result of increased efficiency in the manufacture of the apparatus itself but it has also come about in part by the reduced cost of current now obtaining at many points throughout the Dominion, as well as by the introduction of a well-nigh perfect control which guarantees against the use of any unnecessary current. In addition the quality of the product of the electric stove seems to more than hold its own with that of the coal stove or the gas range. This will be a strong argument with the user after he has once become accustomed to the use of the electric cooker. Electric cookers further, especially the fireless variety, develop practically no heat in the room and so are specially appreciated in hot weather.

Among the other summer loads which may be developed under certain conditions is that of lighting amusement places or the operation of amusement equipment by motor drive, the supply of current to buildings that have isolated plants operated by exhaust steam during the winter, but which cannot operate economically during the summer. Another load which might be developed in many towns is that of refrigerating apparatus. At the present time there is on the market an efficient household refrigerating equipment driven by a small motor. This motor circulates brine around the refrigerator which has been cooled by the ammonia process. Its operation is exceedingly simple and efficient and the initial cost not great. The charging of storage batteries is also a useful type of load and should be developed as far as possible, as the use of the battery can be made much more general than it is at present.

Renfrew Electric Manufacturing Company, Limited, has been incorporated with a capital stock of $50,000 to manufacture and deal in electrical machinery, appliances, etc., with head office at Renfrew.

Important Problems in Telephone Work

Electrical Interference Between High Tension Circuits and Telephone Circuits—The Remedy in Theory and Practice (Con. from April 15)

By Mr. C. A. Buckard

The first half of this article dealt with the theory underlying the interference between high tension currents and telephone lines and we will now consider the application of this theory.

While theoretically application as shown in the discussion thus far the telephone circuit can be operated in the vicinity of a high tension circuit the actual application of any method and especially the use of transpositions is complicated by conditions in the telephone plant itself. Where more than one telephone circuit is in parallel proximity to other telephone circuits on the same route, they react inductively on each other producing what is known as crosstalk or overhearing. To overcome this the telephone company have adopted systems of so-called crosstalk transpositions. For ordinary physical circuits the system shown in Fig. 4 is sometimes used.

Among the ingenious circuit schemes which have been developed in telephone work is the circuit known as a phantom. This really is, however, a true physical circuit, the general idea being given as follows: By a combination of repeating coils, i.e., transformers, it is possible to have three independent telephone circuits on four wires, the scheme of the circuit being shown in Fig 5. This circuit being a true physical circuit it becomes necessary to transpose this against other similar phantom circuits, against the physical circuits of which it is made up and against other physical circuits all on the same route or pole lead. Systems of transposition to do this have been developed such that the so-called phantom transpositions are superimposed on the system of physical transpositions as given in Fig. 4, and fulfill all the requirements in a very satisfactory manner.

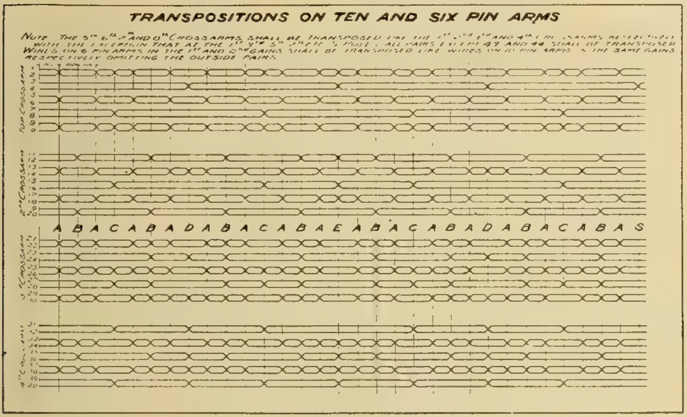

TRANSPOSITIONS ON TEN AND SIX PIN ARMS
TOP CROSSARM
2nd CROSSARM
A B A C A B A D A B A C A B A E A B A C A B A D A B A C A B A S

Fig. 4

If transpositions in the telephone circuits against high tension systems are to be introduced they should not unbalance the crosstalk transposition system. Just how this is done can best be described by taking up typical cases and how they are treated.

When trouble in a telephone line due to an exposure with a high tension circuit is reported the following information is obtained:—

1. Pole diagram of every telephone pole, such diagram to include.
   (a) Type of crossarm used;
   (b) Total number of telephone wires including gauge and pin position;
   (c) Loading coils, crosstalk transpositions, cable terminals, loops to offices or subscribers.

2. Pole diagram of every pole carrying the disturbing wires, such diagram to include:—
   (a) Type of crossarm;
   (b) Total number of wires, type of circuits, arc lights or transformer primaries, etc., and the pin position of the wires of each circuit;
   (c) Transformers, loops from main line, street arc lamps, etc.

3. In cases of underbuilding or overbuilding or joint line construction the vertical separation of the various crossarms carrying the wires of each line.

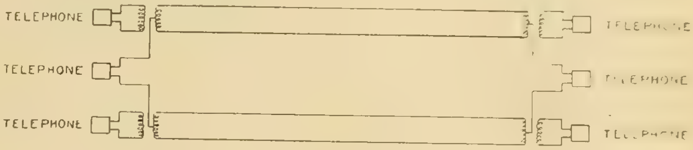


Fig. 5

4. In paralleling lines separated by the width of a street the centre to centre separation of the poles of the two lines.

In Fig. 6 appear pole diagrams which represent the results as would appear in the field book upon completion of a length of line subject to high tension exposure.

From data obtained from the inspection as above outlined the results would be charted similarly to Fig. 7.

On this diagram will be seen, first, the separation of the nearest crossarm of the two lines, pole numbers, location and type of transposition poles, etc., and second, the horizontal spacing of wires of the disturbing circuits; type of crossarm, transformers, arc lamps, etc.

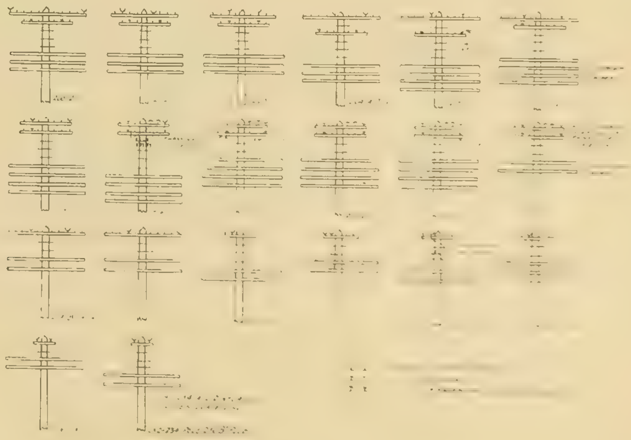


Fig. 6

During the inspection as above outlined particular attention is paid to line insulation conditions and all causes of low insulation or insulation unbalance removed from the telephone circuits. This is a primary consideration in all studies of noisy telephone circuits subject to inductive exposure.

Resistance unbalance is noted, and steps taken towards its removal. Photographs of exposures are obtained and attached to the report.

In Fig. 8 we have a chart as actually made up for an exposure between a telephone circuit and an a.c. series arc light circuit.

The series arc light circuit is operated from a tub transformer carrying a load of about 50 arc lights. In this arc light circuit no attempt is made to keep the two sides of the circuit together, but one wire circulates over different streets of the town with arc lamps cut in at suitable points for lighting the streets. This way of running the a.c. circuit is probably one of the worst that the telephone companies have to contend with. The series arc light circuit is on the same poles with the telephone wires and with 5½ feet separation.

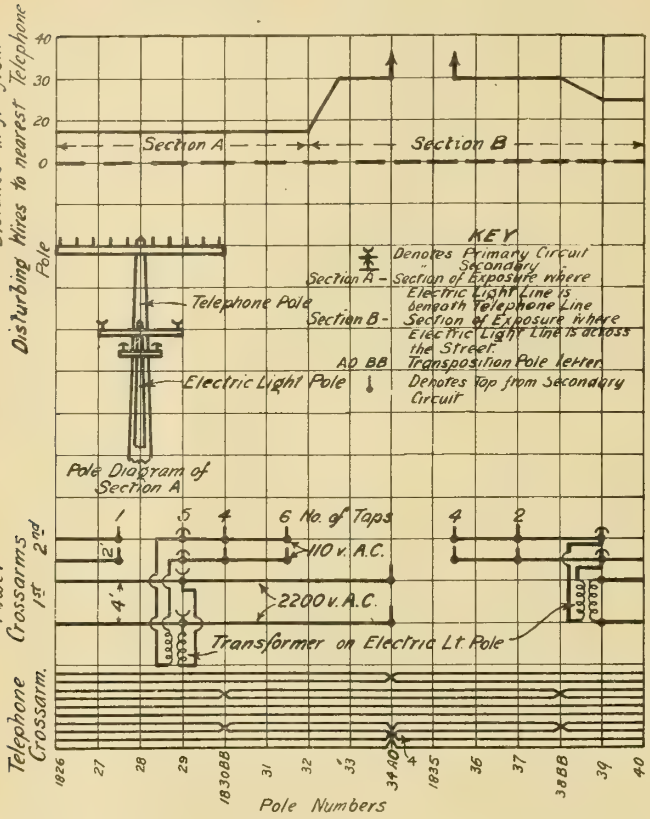

Distance in ft from Disturbing Wires to nearest Telephone Pole
40
30
20
0
Section A
Section B
KEY
Denotes Primary Circuit
" Secondary "
Section A - Section of Exposure where Electric Light Line is beneath Telephone Line
Section B - Section of Exposure where Electric Light Line is across the Street.
AD BB Transposition Pole letter
Denotes Tap from Secondary Circuit
Telephone Pole
Electric Light Pole
Pole Diagram of Section A
Power Crossarms 1st 2nd
1 5 4 6 No. of Taps 4 2
2'
4'
110 v. A.C.
2200 v. A.C.
Transformer on Electric Lt Pole
Telephone Crossarm.
1826 27 28 29 183088 31 32 33 34 AD 4 1835 36 37 38 BB 39 40
Pole Numbers

Fig. 7

On the chart the location of the poles is to scale, each large division horizontally being 200 feet. The crosstalk transpositions are shown on the poles designated by a hollow circle. In order to get the best mutual electrostatic and electromagnetic balance between the power circuit and the telephone circuit it is necessary to have the crosstalk transposition points, neutral points in the scheme of transpositions against the a.c. series arc circuit, that is to say, points where the introduction of a transposition would not affect the balance against the power systems. How well this was accomplished in the scheme adopted is shown in the plot at the bottom of Fig. 8.

The abscissae here represent distance, one large division being 200 feet and the ordinates represent intensity of exposure, one large division representing the exposure of 200 feet of phantom circuit. Where a transposition is cut in, the direction of the induced current would be reversed, therefore we can say the direction of the exposure is reversed, which accounts for the see-saw appearance of the chart.

The design of the transposition scheme against the power circuit is such that the exposure chart comes out at zero value. This means that electromagnetic induction is entirely taken care of and the current due to electrostatic induction is only that due to about 100 to 120 feet exposure. In the case shown it was possible to neutralize the electromagnetic induction entirely but this would not have been true if it had not been a constant current system. The transposition scheme adopted against the power circuit is shown by following through the transposition designated by a cross circumscribed by a circle. In order to disturb the crosstalk balance as little as possible every circuit is transposed. Thus the crosstalk balance of the physical circuits is absolutely maintained and that of the phantom circuit is only slightly unbalanced.

A portion of the field notes of another exposure are shown in Fig. 7.

The power system was a three-wire two-phase system with the primary divided and one-phase running down different streets on one of which the exposure occurs. The spacing between the primary wires in this portion was four feet straddling the pole.

There was low unbalance insulation in the primary wires and the load was also badly unbalanced as indicated by transformers and transformer capacities, the whole resulting in what appeared to be a strong electrostatic field. The telephone wires were from ten to twenty feet away. The potential in each phase of the power circuit was 2200 volts. Normally such a potential with a separation of ten or twenty feet should not give trouble.

From the field notes the chart in Fig. 9 was made up. A study of the chart showed that owing to the character of the load it was impossible to neutralize both electrostatic and electromagnetic induction. As electrostatic induction appeared to predominate it was decided to transpose mainly for that. The transposition scheme adopted is that shown at points with designation by a cross circumscribed with a circle. The intensity of electrostatic exposure is shown in the dot and dash line which comes out at zero.

By obtaining values of current strength in different portions of the power circuit it was possible to plot the intensity of the electromagnetic exposure. This is shown by the solid line. The scale of this has no relation with that of the electrostatic induction and probably the total effect was very much smaller.

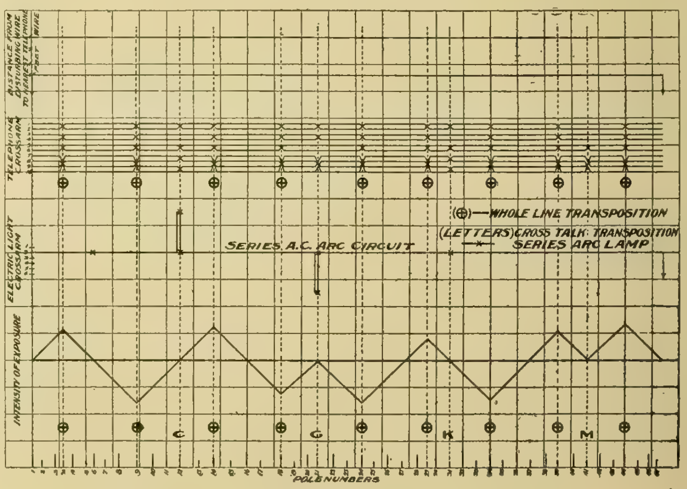


Fig. 8

The load in the power circuit reduced in a direction opposite to that in which the telephone line was transposed, therefore, for convenience the intensity of electromagnetic exposure is plotted from right to left. It will be noted reading from right to left that this comes out with a very small value as compared with maximum condition. Actual tests made after the installation of this transposition scheme verified the correctness of this work.

That the increasing congestion of high tension and telephone lines is a stern reality, is shown in Fig. 10. In this picture the line to the extreme right is a 13200 volt, 3-phase transmission line operating with star connected transformers. Between it and the telephone line is a private telephone line of a 110,000 volt transmission system. The 110,000 volt line is on a right-of-way entirely apart. To the extreme left is a rural telephone line. Next to this is a 60,000 volt, 3-phase transmission line operating with open delta connected transformers. Between the telephone line and 60,000 volt transmission line are the towers of a new 85,000 volt transmission line. In this instance there will be operating three high tension systems and two telephone systems in a right of way about 150 feet wide. It is needless to say that the four arm telephone line was the first occupant of this right-of-way.

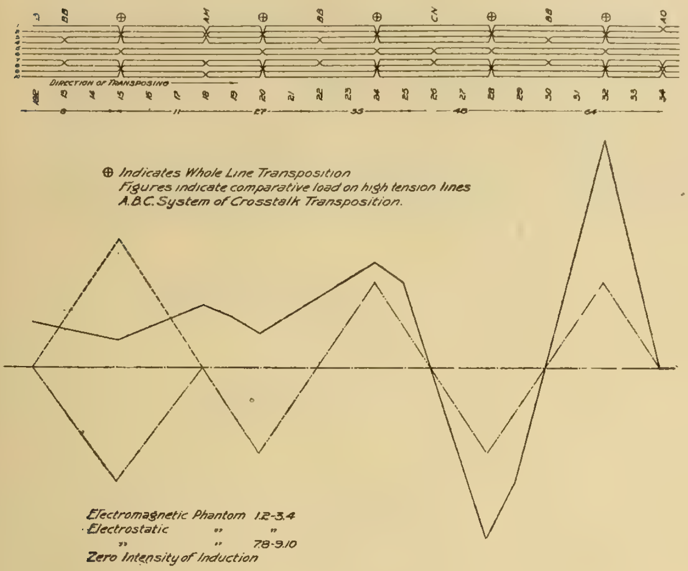

DIRECTION OF TRANSPOSING
ABC
8
11
27
33
48
64
⊕ Indicates Whole Line Transposition
Figures indicate comparative load on high tension lines
A.B.C. System of Crosstalk Transposition.
Electromagnetic Phantom 1.2-3.4
Electrostatic " "
" " 7.8-9.10
Zero Intensity of Induction

Fig. 9

From the foregoing article it can be clearly seen that telephone companies are put to considerable expense and inconvenience to remedy troubles which are brought upon them by parallelism with high potential power circuits. The best solution of this problem is to keep the conflicting systems as far apart as possible. Where close parallelism is unavoidable some rule for minimum distance for separation ought to be developed depending on the electrical conditions involved. In this connection the following quotation is of interest:—

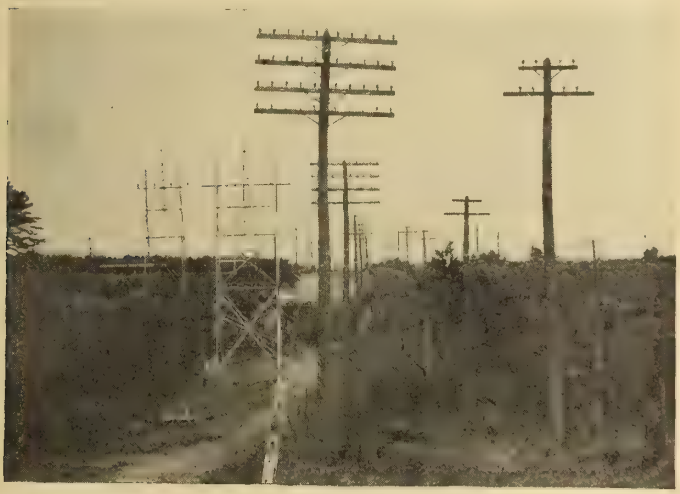


Fig. 10

"We know that electric power circuits may, and occasionally do, interfere with their weaker brothers, the telegraph and the telephone systems. The problem before us now—which is not a problem of interest only to the power engineer or the railway man or the telegraph engineer, but one of great importance to the electrical engineering profession at large—cannot be solved by saying that we are power engineers and expect the telegraph and telephone systems to take care of themselves. This would be as unfair and untenable as it would be for the telepgraph or telephone engineers to say; we were the first ones in the field and must not be interfered with, and we insist that the electric power systems shall be installed in such a manner as not to interfere with us."

This quotation is from Dr. Steinmetz in a discussion of inductive disturbance before the American Institute of Electrical Engineers.

Vancouver Increasing Facilities

Demands upon the telephone system of Vancouver are indicated by the increased facilities being made at Seymour, Fairmont, Bayview and Highland exchanges for handling daily traffic. This applies not only to traffic in and out of these exchanges, but also to inter-office business, which is constantly expanding.

At Seymour, in addition to the sections of "A" board now being put in place, six switching trunks from L. D. are to be installed, which will give a capacity of thirty-six trunks. A large toll business is done to and from Seymour, and it has been found that the thirty switching trunks now carrying the load are not sufficient. Inter-office trunks out of Seymour are also being increased in number, eight being installed to Bayview, which will give a total to this exchange of sixty-six.

Considerable additions are also being made to Bayview. Eight more trunks are being added from Seymour to Bayview, this number having been found necessary to take care of the increasing traffic between downtown and that portion of the city west of Willow street, which includes West Fairview and Shaughnessy Heights. Five more trunks are being connected to Fairmont. Bayview has also had twenty local trunks installed, giving it a capacity of sixty. It is expected with these additional facilities to meet the demand now existing.

The same conditions apply to Fairmont. Here, too, twenty local trunks are being installed, and in this instance also the total capacity for traffic in that part of Vancouver will be sixty trunks.

In New Westminster the capacity for recording toll traffic is being doubled. A one-line position has been used there, but a separate two-position recording board is being installed to take care of the long distance calls from New Westminster subscribers.

Highland is to have twelve additional inter-office trunks, and four more long distance trunks.

In the two-number district, adjacent to Vancouver, expansion is steady. Five more trunks are being put in between Seymour and Collingwood; ten more to Eburne, and ten additional between Fraser and Vancouver.

Practically all the work has been done for installing a telephone despatching system on the Toronto, Hamilton and Buffalo Railway, a subsidiary of the C. P. R. Most of the western lines of the C. P. R. are now operated by telephone.

Cable Under Saanich Inlet

Shipment has been made of the cable which will be laid under Saanich Inlet, giving connection to the two land sections of the new line between Nanaimo and Victoria, which will complete the circuit between Vancouver and the Capital City, when the big cable is laid in June. The cable, which consists of 14,000 feet of ten-pair thirteen-gauge wire, was manufactured by the British Insulated and Helsby Company, of Prescott, Lancashire, England. It will be brought overland from the Atlantic coast, so that it can be put in place and be in readiness before the cable is laid across the Gulf of Georgia.

Extensions in Point Grey

The B. C. Telephone Company recently completed the estimate which covers extensions to the system in the Eburne and Kerrisdale section, Point Grey. So rapidly has this residential district forged ahead within the last two years that the company regard it as a suburb where development has to be anticipated.

The seven hundred poles necessary for construction of the aerial lines were in place by the first of April, and stringing of the cable is now being done. There will be about ten miles of cable altogether, made up as follows: 11,700 feet of 400-pair; 4,000 feet of 300-pair; 8,000 feet of 200-pair; 2,000 feet of 150-pair; 10,000 feet of 100-pair; 9,000 feet of 50-pair, and 6,000 feet of 25-pair.

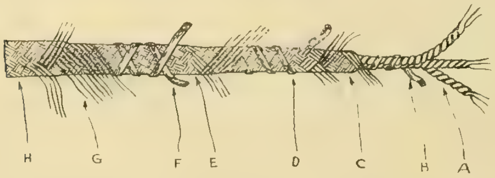
In conjunction with this construction might be taken the West Bayview estimate, which will take in the territory from Yew street west to Blanca Drive in Point Grey. Along with this will be the land line of the new cable across the Gulf, and by July 1st it is expected that the company will be in a position to supply service to every resident of Point Grey peninsula. These estimates will not only supply relief to sections at present congested, but will furnish facilities for service where none now exist.

The Switchboard Cord

The switchboard cord, so often carelessly handled, seems at first sight to be a very simple affair, whereas a closer glance will reveal it to be very intricate.

On account of their being constantly in use, the delicate wires inside are easily damaged or broken, and the majority of telephone apparatus manufacturers agree that the cords are one of the most difficult parts of the switchboard to turn out satisfactorily.

The attached sketch will give some idea of the interior of the cord. The core (a) is formed of linen twine upon which is wound the first, or tip (b) conductor of flat steel wire. Over this are placed three layers of insulation consisting of two wrappings of silk and a braiding of linen (c). The second or ring conductor (d) is of flat steel wire also, but it wound on the core thus formed in a direction opposite to the first conductor. Two wrappings of silk are next placed over the entire length of the core (d) and then a braiding of linen (e). Over these are wound two separate conductors, one of coppor ribbon and the other of flat steel wire, which forms the third or sleeve conductor (f). Over these are placed two wrappings of silk (g) and over the silk for a distance of 16 inches at the plug end of the cord there is placed a braiding of cotton (h). The whole is then covered with a braiding of glazed cotton, having an additional braiding for about twelve inches at the plug end to reinforce that part of the cord subjected to the most severe usage.



Switchboard Cord

It will thus be seen that the switchboard cords are very easily damaged and a knowledge of their construction will enable those who handle them to appreciate the advantage of using them carefully.

New Telegraph Lines

New telegraph lines are provided for in British Columbia as follows:

Alberni-Clayoquot telegraph line—for telegraph and telephone extensions beyond Clayoquot to Estevan Point, and Friendly Cove, $23,200.

Queen Charlotte Islands—Telegraph line beyond Dead Tree Point to Masset, $13,750.

Vancouver-Powell River telegraph line—Construction of branch line from Point Atkinson to Newport along Montague Channel, $8,500.

Personals

Mr. J. Antonisen, city engineer of Moose Jaw, has been appointed superintendent of the Brandon municipal street railway system.

Mr. H. H. Cousens, the newly-appointed general manager or the Toronto Hydro-electric System, sailed for Canada May 13 by S.S. "Megantic."

Mr. J. D. Evans, former chief engineer of the Montreal Tramways Company, was recently elected a member of the American Society of Civil Engineers.

Mr. W. R. Sweany, formerly acting manager of the Toronto hydro-electric system has been appointed general sales manager of the Toronto Electric Light Company.

Mr. R. T. Morris, municipal electrician of South Vancouver has resigned to associate himself with Mr. G. M. Gest, the well-known conduit engineer and contractor.

Mr. Howard Murray, treasurer of the Shawinigan Water and Power Company, Montreal, has been nominated as the new president of the Montreal branch of the Canadian Manufacturers' Assocaition.

Mr. F. W. Caldwell has been appointed superintendent of the Edmonton municipal telephone system. Mr. Caldwell comes from Spokane where he has been superintendent of the home telephone company. It is understood he will retain both positions.

Mr. W. G. Murrin has been appointed mechanical superintendent of the British Columbia Electric Railway and recently assumed the duties of the position. Mr. Murrin comes from London, England, where he was connected in an executive capacity with the staff of the London United Railway.

Mr. D. R. Kennedy, electrical superintendent of the British Columbia Electric Railway has resigned his position and Mr. W. H. Fraser who has been connected with the electrical staff of the company, has been appointed in his place. Mr. Kennedy will spend the next few months travelling through the United States and the Dominion, inspecting various electrical plants.

Mr. E. E. F. Creighton, consulting engineer to the General Electric Company, Schenectady, delivered an address on April 25th before the Toronto section of the A.I.E.E. The address dealt with electrical disturbances on high tension lines and was particularly devoted to the explanation of the phenomena of high tension surges. Some exceedingly interesting experiments were shown in corrobation of the theory advanced by Mr. Creighton.

Electric Railways

Greater Toronto's Railway System — Trackage to be doubled in five years—Subways a last resort

A report on the transportation situation, present and future in Toronto, has just been presented to council by Mr. Bion J. Arnold, consulting engineer, of New York, with whom was associated Mr. John W. Moyes, of Toronto. The report deals with the present congestion and outlines at considerable length two alternative solutions. The first of these is based on the immediate purchase of the Toronto Railway Company's system, to which additions would be made during the next five years, costing in the neighborhood of $8,700,000. The other alternative is to build a double track subway from St. Clair avenue to Queen street, with auxiliary surface lines covering the suburban areas, including the recently annexed sections of the city or immediately outside of these. The latter would cost about $10,500,000.

The report states that Toronto has outgrown its transportation facilities and is in need of immediate relief. At the same time it appears that few difficulties stand in the way of a larger transportation expansion. If it were possible to face these difficulties through co-operation of the different interests involved, relief could be acquired quickly, but failing this, the alternative plan of a subway is suggested. In many respects the conditions covering the traction situation in Toronto are better than in other cities, particularly because of the favorable location of its business centre and its geographical surroundings, and especially so because the earning capacity of its transportation system has been so developed that any reasonable improvements may be put into effect without any general disturbance of either the financial or operating conditions of the company.

In some respects the service in Toronto is better than in many other cities. Car congestion could be remedied by the re-routing of a few lines in the congested district, and over-crowding at certain periods could be largely eliminated by the addition of a few cars on the trunk line. Revised schedules based on faster operation would greatly improve the service even without the addition of any more rolling stock. This may be greatly aided by a more careful training, tending to produce alertness on the part of the conductors and motormen, and thereby inducing more activity on the part of the public when boarding and alighting from cars.

Cross-town lines in certain sections are needed and extensions to existing lines should be built into outlying territory not only for the accommodation of those who are already there, but for the purpose of developing the unsettled districts not far from the business centre.

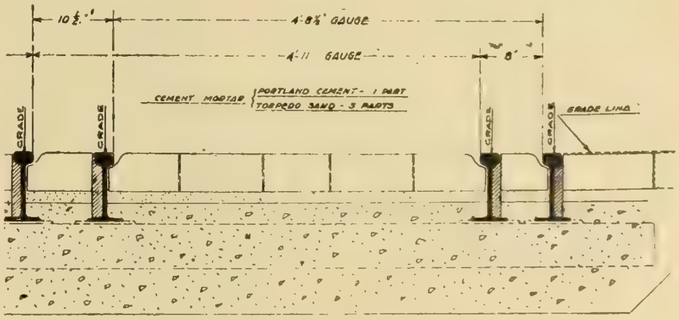
With the transportation affairs of the city under unified management subways would not be warranted. Yonge street, the present point of congestion, is not now carrying all the cars it could, and other streets such as Church, Victoria and Bay could accommodate several times the number now using them. Subways should be looked upon in the nature of a last resort. Toronto does not at present need subways nearly so much as it needs more surface tracks and more and better and faster surface cars, preferably under unified management.

Since 1907 the population of Toronto has increased at an average of nine per cent. per year. During that period car track mileage has increased only 2.4 per cent. per year. The number of car miles operated has increased during the last two years at the rate of 2.25 per cent. per year. During the period 1907 to 1911 inclusive, the gross income of the company increased at an average of 9.6 per cent, per year, showing a large and constant increase in receipts without a corresponding increase in service rendered.

The Toronto system earned $4,851,541 in 1911 and, assuming this rate to be maintained, the earnings in 1921 will be approximately $14,000,000. At the present time over $12 per capita per annum is being used for street car transportation in the city of Toronto.

The rolling stock consists of a mixture of large and small motor cars and trailers. The trailers should be retired and the single truck cars provided with truck guards and placed on cross town lines or on streets where the travel is light. Modern practice unmistakably points to the acceptance of the prepayment type of car for city service. In this type of car the platforms are of ample dimensions and so arranged as to separate incoming and outgoing passengers, thus facilitating the loading and unloading of passengers.

Recent track and road bed construction in Toronto is along modern lines except for the use of the local wide gauge. This should be standardized under any general reconstruction of the system and about 35 per cent. of present track rebuilt in the next five years. Car stations should be of fireproof construction and divided into sections so that no more than 25 or 30 cars would be subject to fire loss at one time.



Arrangement for tracks of different gauge.

The power for the supervision of the maintenance of the physical property as well as its operation should be vested in a provincial or a municipal board clear of political bias and of unquestioned integrity and professional skill.

This board should be empowered by legislation to fully enforce its mandates.

Present Traffic Conditions

Under the above heading the report publishes some interesting figures of existing conditions in Toronto. The Toronto Railway Company is at present operating 113 miles of single track, 4 ft. 11 in. gauge, over an area approximating 10¼ miles in length east and west, by 3¾ miles in extreme width north and south. The number of cars in operation is 642, consisting of 569 double truck and single truck cars and 73 trailers. With this equipment the company in 1911 carried 121,000,000 cash and 49,000,000 transfer passengers. The gross receipts were $4,851,541.

To handle the same amount of business it is stated that other cities are provided with more cars and more tracks, the average of nine United States cities being about one car for each 500 of population and one mile of track for each 1,800 of population and one mile of track for every $23,000 of receipts. A comparison is made between Toronto and eight other cities showing the relative number of miles of track, populations, gross receipts, miles of track per thousand inhabitants, receipts per capita, receipts per mile of track and population per mile of track. These figures are reproduced herewith in an accompanying table from which it will be seen that Toronto is by far the highest in receipts and population per mile of track, but is lowest in trackage for each thousand inhabitants and is slightly below the average in receipts per capita.

Track Extensions

The track extensions are distributed over the years 1913, 1914, 1915, 1916 and 1917, the amount to be laid each year being approximately constant. By the latter date the mileage of greater Toronto would be increased from the present 113 miles to a total of 240, an addition of 127. This is divided approximately into 32 miles of single track in the old city limits of 1891; 10 miles in the territory annexed since that date; 28 miles of radial lines to be added to the city system; 40 miles in the territory outside the present city limits; and 17 miles now being built by the city. It is estimated that the construction of these extensions would cost approximately $2,617,427. This would include new lines to be built, civic lines now being constructed but not in operation, improvements to radials as outlined, crossings and other subway work, electrical overhead control wire and feeder cable with necessary poles, the city furnishing the roadbed and pavement.

For any but the streets of heaviest traffic the use of T-rail is recommended. For the heavy traffic district the groove rail should be used. Where the T-rail is used, however, and the street is paved, and if granite block is used for pavement, the blocks in contact with the rail should be uniformly cut so as to form a groove for the flange of the wheels. Where brick is used those in contact with the rail should be specially moulded to accomplish the same purpose.

Curves should be built so that cars can pass without interference. Frequently this will require the rounding off of a few feet on the corner sidewalk. The car movement in Toronto at several of the congested points would be materially aided and the average speed of the cars increased, without increasing their maximum speed, by the substitution of this class of special work for the present narrow centre work.

It is estimated that the system outlined will require 1,100 cars for the transportation of a population of 718,000 in 1921. With 500 of the present cars retained in service on light lines of travel, or rebuilt, there will be required 150 new cars to replace trailers and the poorer class of single truck motors. As fast as new lines are added to the system and population increases, new cars will be needed, the estimate being 250 at the end of five years. The rest of the final requirements should be placed in service at the rate of 50 per year.

Cost and Returns

The total cost of the proposed additions of 127 miles of new track, 600 modern prepayment cars, additional car houses, substations and other necessary equipment would be in the neighborhood of $8,762,000. An additional expense would be incurred if it were decided to place the electrical feeder and return cables underground. Under Toronto conditions the cost of these ought not to exceed the following: manholes $98 each; iron pipe laterals, 60c per foot; conduits, 41.6c for two ducts to 10.17c for 48 ducts, per duct foot. The total cost of improvements as mentioned above is divided approximately as follows:

Cost of Improvements

Track construction, 127 miles of single track (3.5 miles grooved rail; 123.5 miles "T" rail)	$2,127,000
Overhead wires, poles and cables	489,000
Car-houses	820,000
Cars	4,500,000
Power stations and equipment	726,000
Miscellaneous equipment (work cars, snow and ice machinery, line wagons, sprinklers, etc.)	100,000
Total	$8,762,000

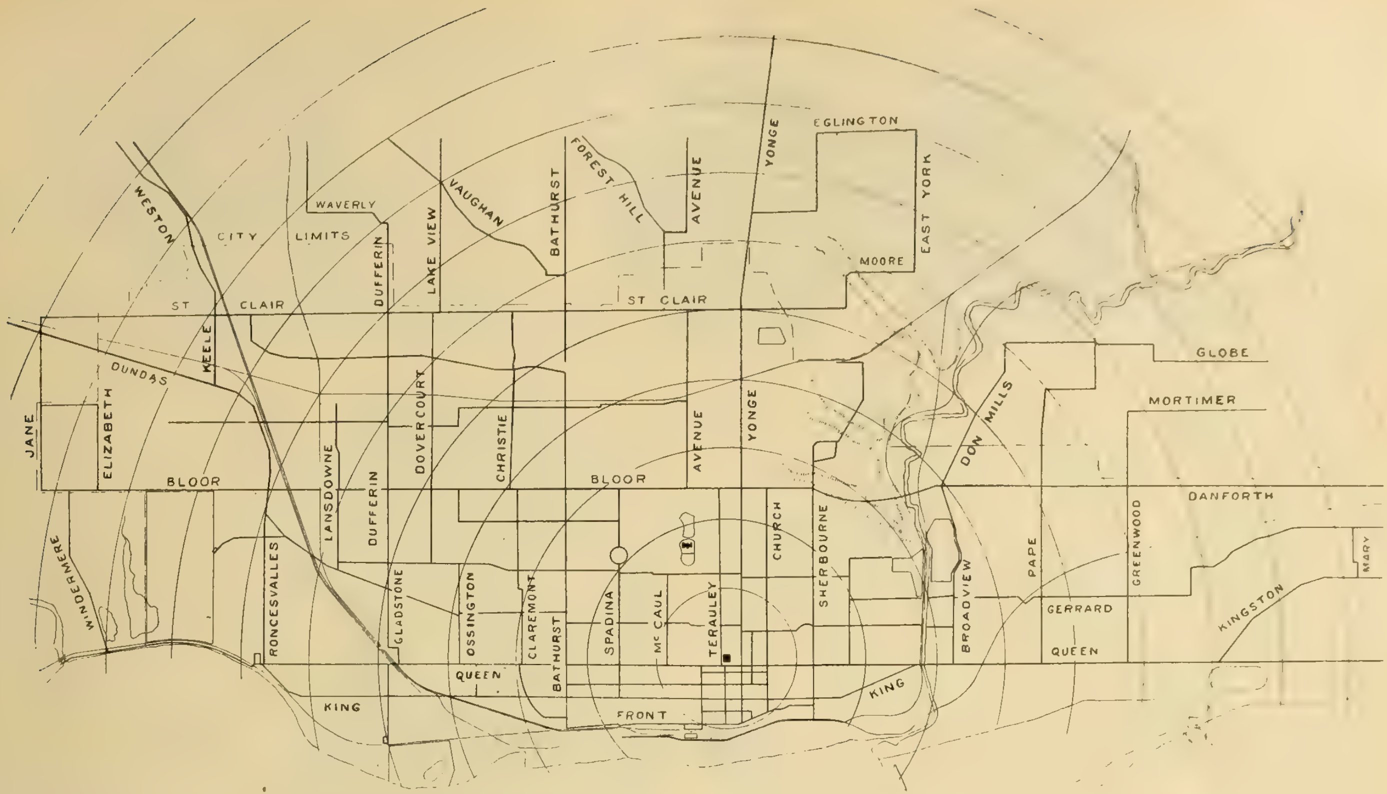
Presuming the completion of the above additions by the close of 1917 the financial showing for the year 1918 for the entire system of 240 miles of track is estimated as follows:

Gross earnings	$10,800,000
Operating expenses, taxes, renewals, pavement charges, etc., at 70 per cent.	7,560,000
Net earnings	3,240,000

The above estimate is considered very conservative for the following reasons: (1) The earnings are based upon the present riding habit, which averages $12.40 for the city, as it is now covered by the present limited traction lines. Were the complete system considered by this report to be now in operation, there would unquestionably result a higher earning per capita than $12.40, which projected into the future, upon the proper law of increase, would result in gross earnings in excess of the above named figure. (2) Owing to the

TABLE COMPARING TORONTO WITH OTHER CITIES.

City	Miles of Track	Population	Receipts	Miles Track per 1,000 persons	Receipts per capita	Receipts per mile of track	Population per mile track
Washington	217	331,000	$6,349,000	.656	$19.18	$29,258	1,525
New Orleans	200	339,000	4,206,000	.590	12.41	21,030	1,695
Baltimore	400	559,000	7,687,000	.716	13.75	19,220	1,397
Cincinnati.	222	364,000	5,005,000	.610	13.72	22,540	1,640
Cleveland	245	560,000	6,123,000	.437	10.93	24,990	2,286
Toledo	116	168,000	2,000,000	.690	11.90	17,241	1,448
Seattle	188	237,000	3,660,000	.790	15.44	19,470	1,261
Milwaukee	145	374,000	3,787,000	.388	10.13	26,114	2,579
Toronto, 1911	113	390,000	4,851,000	.289	12.44	42,929	3,451



Surface Electric Railway System of Greater Toronto. Circles represent half mile distances with centre at City Hall.

possibility of very cheap power being available for the operation of the entire system, an operating ratio as high as 70 per cent. is probably the maximum that would be encountered (including pavement charges). With such power supply the actual operating ratio will probably be in the neighborhood of 65 per cent. (exclusive of pavement charges). Thus, the estimate as based on minimum earnings and maximum operating ratio, necessarily gives the minimum net earnings that would be expected. This amount, $3,420,000, capitalized at 5 per cent., would support an investment of $64,800,000, or capitalized at 8 per cent., approximately $40,000,000. These figures may be assumed correct on the theory of a continuing investment on the part of the municipality or a company, but they should be reduced by whatever amount is found necessary to amortize the investment within the franchise life if the property is developed and operated by a company under a franchise for a fixed period.

The Alternative

On the supposition that the Toronto Railway Company's system is not bought out and that the two systems are operated independently for the next nine years, the only alternative seems to be a subway system with a terminal in the centre of the city, as it is understood the city is in a position where it cannot operate on the level owing to rights held by the Toronto Railway Company. Subways have their uses in congested areas where surface terminals are insufficient for traffic needs and where elevated structures would be objectionable. For the support of subways there should be densely populated districts some distance from the business centre seeking rapid transit which other means of transportation are unable to provide. The subways of New York and Boston were not constructed until after all other classes of transportation had reached their limit of carrying capacity. Under these conditions only will the subway, as a subway, pay its way. As an inlet for an extended system of surface lines serving a large territory, the governing reasons for the adoption of a subway change to such an extent that its construction is occasionally warranted. The location of the main branch of the subway proposed is from St. Clair avenue down Yonge street to Queen, a distance of 13,375 ft. of double track; a single track downtown subway loop, 2,240 ft.; a double track subway in Bloor street, 2,700 ft.; double track under embankment drive, Sherbourne to Parliament, 1,600 ft.; double track under bridge driveway over Rosedale Valley 565 ft.; double track subway Valley Bridge to Don River bridge, 970 ft.; double track under bridge driveway over Don River, 1665 ft.; double track subway, Don River bridge to Broadview, 450 ft.; a total of four miles of double track and approximately one-half mile single track.

The subway would be fed by an open territory capable of expansion to a surface system of 27 miles of single track to the north and about 17 miles to the northeast, the total being given as 44 miles of single surface track. The surface additions proposed are practically the same as those recommended in connection with the unifying of the system using all surface lines, only small changes being made in the details of the routes.

It is estimated that 150 cars would be sufficient to operate the underground and surface lines giving a 1½ minute service throughout the greater part of the subway system and a ¾ minute service below Bloor on Yonge. This service would be capable of handling 10,000 passengers per hour. It is calculated that the subway would be capable of eventually carrying over 250 cars per hour, but this would be at a considerable sacrifice of speed. The estimated cost of the whole alternative system, including subways, surface tracks and all the necessary auxiliary equipment is placed at $10,473,000, distributed approximately as follows:

Costs

Double track subway in Yonge street	$4,328,000
Single track subway loop	496,000
Danforth Avenue Branch (Yonge to Broadview) ..	1,338,000
Carrying charges on terminal system (7½) per cent. during construction (2½ per cent. per yard).	462,000
Double track surface lines (17 miles)	1,490,000
Single track surface lines (10 miles)	472,000

P-A-Y-E steel cars (150 at $8,500)	1,275,000
Car houses	320,000
Substations and equipment	242,000
Miscellaneous—work cars, line wagons, snow, ice, and sprinkler equipment	50,000
Total	$10,473,000

It is calculated the gross receipts from the first year's operation of this system would be $1,204,000. After deducting 62 per cent. for operating expenses and maintenance, there would remain $457,520 to meet fixed charges, renewals, taxes and amortization.

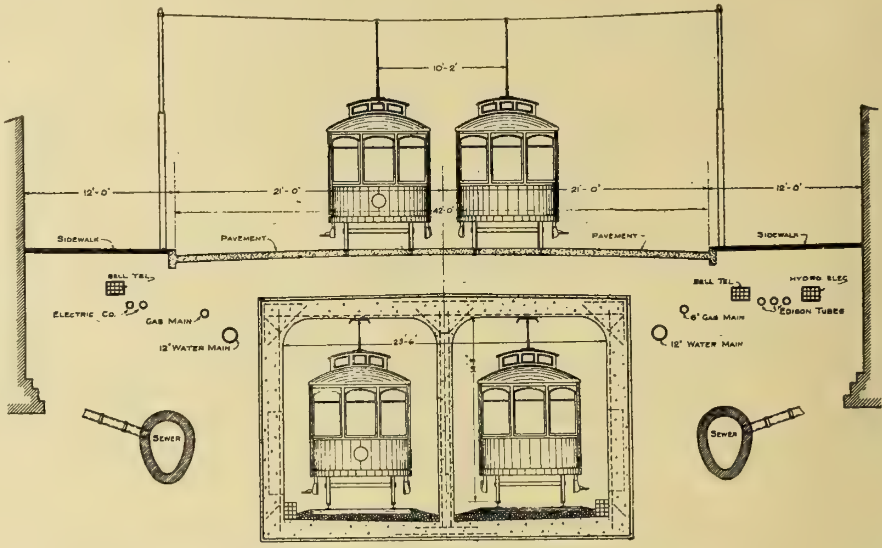
Motor Busses

A section is devoted in the report to the success that has attended the operation of motor busses in a number of cities situated somewhat similarly to Toronto. Their use in Toronto is not considered advisable. The motor bus can be profitably operated only in districts where traffic is continuously heavy, on short hauls from one congested centre to another, or by charging more than the regular street car fare. Toronto conditions do not seem to warrant the experiment.

A number of experiences of other cities are recounted. In New York City for the year 1911 on a gross business of $500,000, a deficit of $38,000 was reported. This was a 10c fare.

With reference to the question of routing the suburban cars over the present city lines, the report points out that the matter is somewhat complicated owing to the several Toronto companies using different widths of tracks varying from 4 ft. 8½ in. to 4 ft. 11 in. The joint use of the city tracks will require a change in the gauge of either the city or the radial lines to conform to some agreed standard, preferably 4 ft. 8½ in., before such service can be inaugurated. The city lines are 4 ft. 11 in. gauge. The report then goes on to suggest the basis of agreements by which the outlying lines, especially the Metropolitan, would be allowed to use the city tracks.

The report contains a number of very useful and interesting photographs and diagrams, a few of which we reproduce. Fig. No. 1, in the report, represents the actual distribution of the sleeping population of Toronto; No. 2 shows the present tracks of the Toronto Railway Company; Fig. 3 shows a suggested arrangement for tracks of different gauge in the centre of the same street, shown herewith; Fig. 4 is a map showing the complete proposed system of tracks for the Greater Toronto district shown herewith; Fig. 5 shows the proposed new tracks for the Greater Toronto district; Fig. 7 shows cross sections of the modern grooved rail and the accompanying track construction. Fig. 8 is a cross section showing modern T-rail and track construction. Fig. 9 is a cross section of a standard conduit construction. Fig. 10 shows a plan and section of a standard manhole; Fig. 11 shows a typical track layout on a heavy business corner; Fig. 12 shows a plan in section of a modern p.a.y.e. car; Fig. 13 seating arrangements of same; Fig. 14 is a plan showing the arrangement of tracks and rooms in a modern car house; Fig. 15 shows an elevation and section of same; Fig. 18 represents the alternative layout, including the proposed subway, terminal, and surface tracks in the suburban districts feeding the subway; Fig. 19 is a plan showing a single track subway station; Fig. 20, a double track subway station; Fig. 21, shown herewith, a cross section showing proposed double track subway; Fig. 22 showing proposed single track loop in the heart of the city; Fig. 23 is a cross section of proposed single track subway; Fig. 24 is a cross section showing concrete elevated structure for use on a private right-of-way; Fig. 25 is a cross section showing proposed tracks on River and Valley bridges connecting Bloor street and Danforth avenue; Fig. 26 shows typical sections of roadway construction for tracks in the Rosedale Valley.



Cross section of proposed double track subway.

Moose Jaw Electric Railway

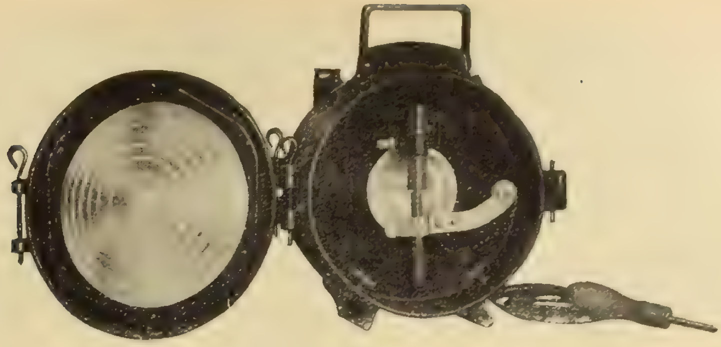
The annual meeting of the Moose Jaw Electric Railway was held in Moose Jaw on Wednesday, April 30th, and the reports showed that very satisfactory progress had been made in the past year. A total of 1,607,770 passengers were carried during the year and the gross receipts were $77,996. A dividend of six per cent. was declared. In view of the fact that nearly all the directors of the company are Ottawa men, it is interesting to note that the results of the first year's operations of the Moose Jaw electric railway closely approximate those of the first annual report of the Ottawa Electric Railway Company, which carried 1,520,408 passengers and earned $71,698 in its first year, though Moose Jaw is at present only half the size Ottawa was when its street railway was started. These results are indicative of the greater present-day activities of the average citizen.

The assets of the Moose Jaw Electric Railway are placed at $573,367, of which $570,128 is in plant, property and equipment, and the balance of $2,239 is in accounts receivable. The liabilities are, capital stock (paid up), $480,271; bills payable, $15,359; accounts payable, $22,581, and a profit and loss surplus of $15,359.

The earnings of the company showed a steady increase month by month and indications are that the increase will continue. At present the company has nine miles of track in use and operates twelve cars. Eight miles of additional track are to be added this year and an order for ten new cars has been placed with the Ottawa Car Company, two of which have already been shipped.

The board of directors elected were:—president, A. A. Dion; vice-president, Newton J. Kerr; secretary-treasurer, D. R. Street, E. J. Daly, E. O'Connor, T. Frank Ahearn, P. B. Mellon, A. H. Dion, and Charles E. Armstrong.

Type "LK" front view


Type "LK", front door open.

New Type of Headlight

The accompanying illustrations show a new type of luminous headlight just placed on the market by the Crouse-Hinds Company of Canada, Limited. These new headlights, named the "Imperial," are manufactured in two types, "LK" and "LP." Both have cast iron cases which are divided into two compartments, the front compartment containing the electrodes, electrode holders and a 4-inch spherical aluminium reflector. The rear compartment contains the operating mechanism.

This form of construction protects the operating mechanism from the fumes and deposits caused by the consumption of the electrodes which would in time prevent the proper performance of the headlight. All parts within the case are mounted directly to the barrier separating the two compartments. Each compartment is provided with a cast iron door which permits easy access to the interior parts.

The upper electrode (positive) and the lower electrode (negative) have an approximate life of 4,000 and 125 hours respectively. No inner globe is required, which, added to the low cost of electrodes, reduces maintenance charges to a minimum. The height of the head light is 12½ in., width 12½ in., depth with regular semaphore lens 8 in., weight 35 lbs.

The type "LP" head light is arranged for bolting directly to the dash of the car. The rear door is drilled and tapped for ½ in. conduit through which the lead wire enters the headlight and connects with a contact plate secured to the inner surface of the door. This contact plate engages a spring contact which connects with the mechanism and thereby completes the circuit. Both types operate at 550 volts, direct current, and require from 2 to 4 amperes.

Ottawa Electric Railway Company

The Ottawa Electric Railway Company have decided to change the color of the exterior of their cars from a dull red to a rich dark green. The object of adopting the different color is because it has been found by other street railway corporations to wear better and retain a good appearance much longer. The 20 new cars to be put into use next month will be green, and the present cars will be given the new color as they go into the shops to be repaired.

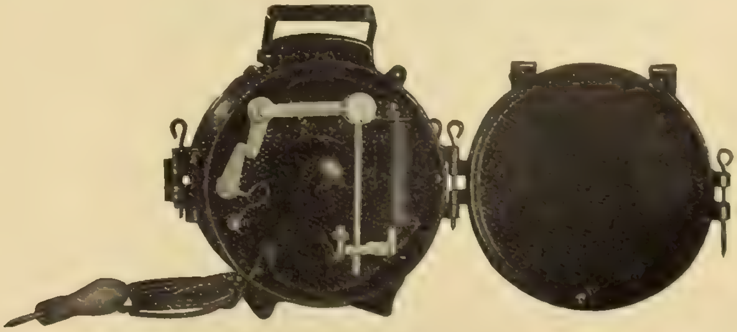
After some discussion between the city council and the officials of the Ottawa Electric Railway Company over the application of the latter for permission to cut off 18 inches of the sidewalk at the corner of Queen and Elgin streets to provide for double tracks leading from Queen to Elgin, the matter has been satisfactorily settled. The owners of the building on the corner in question who are also owners of the sidewalk there have agreed to deed the required 18 inches to the city for the benefit of having a double street car track. It was at first intended to put a single track on Queen street, but following a conference with the civic officials the company have given their promise to proceed without delay with the larger proposition. Work on an extension of the street car lines is to be started at once along Preston street and from the Exhibition grounds to within about 200 yards of Billings Bridge along Bank street.

Ottawa Cars for Moose Jaw

Two more of the ten single truck cars for the Moose Jaw Electric Railway have just been shipped by the Ottawa Car Company, making a total of four shipped to date. The other six are now under construction. These cars have a seating capacity of 32 in 11 cross seats and two longitudinal. The cars are exactly similar in design to the new cars used by the Ottawa Electric Railway. The total length of the car body is 21 feet; total length over bumpers, 31 feet; length of front vestibule, four feet; length of rear vestibule, five feet; exterior width of body, 8 ft. 1¾ in.; interior width of body, 7 ft. 3½ in.; width of aisle, 20 inches; approximate weight of car body, 12,000 pounds. The interior finishings are in red cherry and bird's eye maple veneer. Peter Smith electric heaters are installed and all the other fittings and appliances are thoroughly up-to-date. Each car costs $5,200.

The horse cars along 10th avenue, the lower east side and crosstown, New York, are to be replaced by storage battery vehicles, the Public Service Commission having granted an application of the Belt Line Railways to make the change.

Type "LK", rear view.


Type "LK", rear door open.

Illumination

Electric Lighting in the Home—Modern Requirements in Outlets and Switches

By Mr. F. B. Adam

With the introduction of the Tungsten high incandescence lighting units, an immediate change was found necessary in the scheme of locating and supporting these lamps, and to-day we find in properly designed installations, more outlets of a minimum candle power and always high enough to prevent a direct glare from the lamp into the eyes.

In residences, this means in very large rooms two, four, five or six 25 to 60 watt individual pendants close to the ceiling, instead of the 6, 8 or 10 light chandelier, in the center of the room and coming down as low as six feet two inches from the floor. In the smaller rooms, one or more 25, 40, 60 or 100 watt lamps are used for general illumination and a 15 or 25 watt lamp for the dresser lights. In the bath room, a 25 watt ceiling light, with a 15 watt lamp on each side of the mirror for shaving, and a 15 watt lamp in the closets, will give ample light.

Plug Outlets

Now, in addition to these permanent fixture outlets for lighting, it has become necessary, because of the socket being close to the ceiling, to provide plug outlets for portable lights.

You will find to-day portable table, piano and stand lamps on sale, not only in the lighting fixture stores, but in jewelry stores, hardware stores, department stores, and, I am told, even in the ten cent stores, and you can hardly find a home using electricity that has not at least one, and usually several, portable lights. Therefore, the architect and owner should provide for the convenient connection of such portable lights. Strange as it may seem, the architect specifies Underwriter's inspection and a certificate for the original installation, and then, by not providing for the convenient connection of portable light, heat and power devices, endangers the owner's property when temporary and unsightly connections are used for such devices. It is acknowledged to be a fact that there is danger in the temporary wiring, when used for permanent connections.

As to the number of location of plug outlets, I have in mind an installation where I recommended at least one receptacle in each room and hall on the first and second floors. As the owner purchased his furniture, he found that the locations decided on for these plug outlets did not suit the location of the furniture and we put an additional plug outlet in each room, and after the owner moved into the house he told me he had only one kick coming on the job, and that was that he had not put a plug connection in each of the four corners of each room and hall. As this man is in the electric business, we might excuse him as trying to overdo the good work, but it is a fact that the housewife may want to move the piano, desk or any other piece of furniture into any one of the four corners of the room. Then why not provide for the lighting of the piano or desk in any position that might be convenient or suit the idea of the owner. We should provide for plug outlets about as follows:

Entrance hall—At a convenient point, a stand or table lamp for general illumination.

Parlor—Piano lamp, also table lamp.

Living room—Table lamp in center of room, desk damp for writing desk and lamp for lighting book case.

Dining room—Stand or table lamp for general illumination.

Bed rooms—Table or bed clamp lamps.

These few plug receptacles will cost very little when installed during the construction of a house, and will make a better job with a minimum length of attachment cord to the portable light.

Before leaving the lighting outlet section, I want to suggest something that I believe is new (as we have never seen it specified, but have installed it ourselves) for the first class installations, and that is to specify a separate circuit for the ceiling lights and a separate circuit for the brackets, toilet or plug outlets. With the advent of innumerable heating and cooking devices, the blowing of a circuit fuse has become a regular thing, not from any fault of the lighting system, but entirely on account of overloading the fuse by adding a device that was not intended to be connected to the circuit in addition to the lamps, and the owner will appreciate the benefit of a second circuit in the room when the fuse blows on the first one.

Switches

Strange as it may seem, we have just as much trouble to-day in convincing the architect and owner that the job requires two and sometimes even three switches to control the lights properly in the main rooms, as we used to have ten years ago in convincing them that they should have at least one switch, but the necessity for more switches in the principal rooms should be immediately appreciated when we realize that the lamps and sockets are to-day, in a properly designed installation, close to the ceiling, and for the convenient and economical use of the electric service there must be plenty of switches.

Let us start this time from the porch. One switch for either one or more outlets is usually sufficient.

Entrance hall—Here we should have one switch that will control just enough lights for the general illumination. This switch should be in combination with a switch in the rear of the hall, one on the second floor and sometimes even one on the third floor. These combination switches for the hall and stair lights will pay for themselves many times in the course of the occupancy of the building. Besides the combination switches for the general illumination, there should be a second switch to control the balance of the lights on the fixture.

Parlor—The parlor should be equipped not only with two switches for the ceiling lights, but, on account of the usual style of fixture, with switches for brackets, if brackets have been decided on.

Living room—One switch should be prepared for the reading or table lamp, and not less than two switches for the ceiling outlet, one for the general illumination and one for the better illumination.

Dining room—One switch for ceiling lights for general illumination, in many cases this should be in combination with a second switch placed at the door to the pantry, which will pay for itself by less damage to glass and chinaware. A second switch for the balance of the ceiling lights, and if brackets are used here again they should be controlled by a switch.

Kitchen—One switch.

Pantry—One switch.

Basement stair—One switch, and it will be better yet if in combination with another at foot of stairs.

Second floor hall—If this hall requires only one lamp, it of course should be arranged with a switch in combination with a second switch on the first floor, and a third switch if there is a third floor. If more than one lamp is required for the second floor hall, it will be found economical and convenient to have a second switch for the balance of the lights on the fixture.

Bed rooms—Here again if the room is large enough to justify more than one lamp ceiling fixture, it will be found both economical and convenient to the house owner to have one switch for the general illumination and a second switch for the balance of the lights on the fixture.

I wish to say that from my personal experience it is far better to install two or more separate switches than to use what is known as an electrolier switch, as with a separate switch you turn on and off just the light you want, while with an electrolier switch you must turn on everything to get what you want, and in my opinion it is false economy, as the additional cost of the separate switch per section controlled amounts to only about 75 cents.

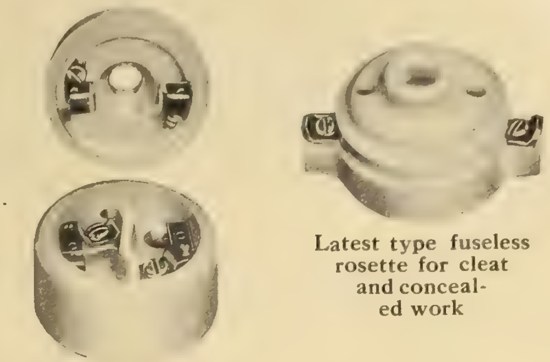
Bath rooms—A switch should always be used for the ceiling light and, as a matter of fact, a switch should also be used for side lights, as, even though using the greatest care, a person turning on a light with a key or pull socket might have the other hand touching a plumbing fixture or actually in the water, and through a defective connection in the socket or fixture receive a severe shock. Where a bath room is used for two bed rooms, it will be found of the greatest convenience to use two and even three switches in combination, so that regardless by what door the bath room is entered, a switch is conveniently at hand.

Closets—The convenience of a closet light can only be appreciated by those using them and the benefits derived from an automatic switch are even greater than when the closet light must be turned on and off every time you want to get something in or out of the closet. The objection I have heard voiced against automatic closet switches is that the closet cannot be properly aired and taken care of and that here is a waste of light when the door is opened, but this can be remedied by a key socket so that the light can be turned off when desired. However, the convenience of an automatic switch in giving light the moment the door is opened should certainly be appreciated.

We should not forget that the greatest argument in favor of the electric lighting service is its practical application and control.

Latest Type of Tungsten Rosette

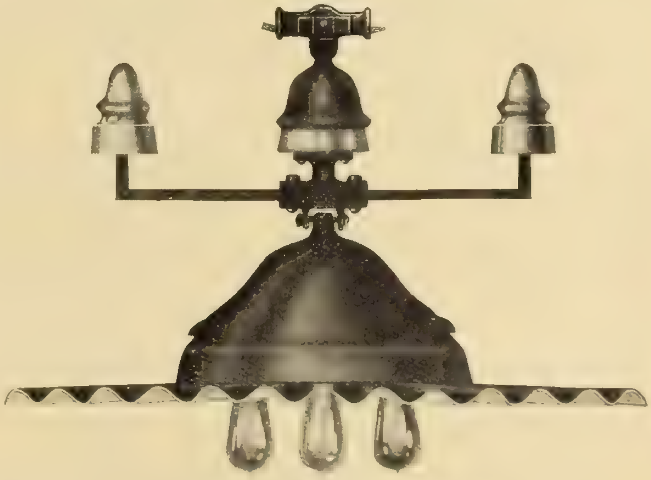
The accompanying illustrations show the latest type of fuseless rosette for cleat and concealed work, manufactured for the Canadian market by the Canadian General Electric Company. There is nothing particularly new or novel in this little device, but its rigid construction, and the extreme ease with which it can be installed and wired should highly recommend it to the electrical trade. In both the cleat and the concealed rosette, contact is made between circuit and the pendant by a pair of spring bayonet clips. These clips are made of extra heavy metal, and they have to carry the weight of the lamp and shade. The contact parts are slightly curved, so as to give a minimum amount of surface, and thus avoid any liability to heating, and consequent annealing of the springs. These curved contact surfaces also avoid the danger of the cap jarring loose, and allowing the pendant to fall. The concealed rosette is made with a deep base, and recessed in the back to allow space for the ends of the tube to project slightly. This makes the use of a sub base necessary, thus saving considerable time in wiring. The brass terminals are liberally designed and the screws fit up close to the grooves, so that there is no possibility of the wire squeezing out, which has been a prolific source of rosette troubles. The above features, combined with a clean cut porcelain, entirely free from burrs and cracks, make up an exceedingly neat and serviceable wiring device.



Latest type fuseless rosette for cleat and concealed work

A Large Outdoor Reflector

For the new two, three and five light fixture put on the market by the Line Material Company of South Milwaukee, a 26-inch radially fluted reflector is provided which is claimed to be the largest of its kind that has been used for this purpose. There are various types of this "many light" fixture made—for bracket suspension, mast arm suspensions, pulley and rope suspension and for span wire suspension. One of these arranged for span suspension is shown in the accompanying illustration. Swiveling at two points insures the hanging of the reflector in a horizontal plane, but by tightening the half-inch bolt above the reflector the fixture can be made rigid if desired.



"Many Light" Street Fixture

Importance of Correct Store Lighting

The lighting of every kind of store is of prime importance, for the successful store keeper must be up-to-date and progressive in all phases of his business. In this age of keen competition, particularly in the retail lines, the shop keeper, to be ultimately successful, must scrutinize carefully every detail of his store arrangement quite as much as his business methods. His store must first be arranged to attract trade and then, when the public has been interested, their trade must be kept by proper goods properly displayed, and courteous attendance. There must be nothing that will tend to displease customers and cause them to go elsewhere. Not only must the quantity of light be correct but the quality must be such as to insure the advantageous presentation of goods without any discomfort to the customer, such as eye-fatigue, etc. In this connection much will often depend on the artistic effect produced by the general illumination or by the fixtures themselves. If customers get into the way of considering a certain store as being properly and artistically arranged they will naturally fall into the way of associating this same store with the properties along the lines of their own requirements.

Four primary factors may be said to enter into the consideration of store lighting. These are intensity, colors, diffusion and even distribution.

Intensity

It is a recognized fact that there is a certain range of desirable intensity of illumination for each class of work in a factory and for different classes of goods on display in the various stores. It is often complained of that modern illumination brings out bad qualities in the goods. This is probably true but these defects must be recognized as inherent in the materials themselves and not the result of any fault of the illumination. Good business methods too recognize the necessity of having any article of merchandise appear to the customer as it actually is. In the long run there can be no advantage in deception. Unfortunately there are customers who do not yet recognize this fact and some indeed whose prosperity to-day is largely the result of deception. This class of dealer often places the engineer in a false and difficult position. In the better stores the designer of course, has a freer hand and he can arrange his intensities so as to bring out the best characteristics of the goods. The intensities must vary of course, with the goods displayed, as for example, a piece of black velvet will require a different intensity of light from white dress goods.

Color of Light

In the large departmental stores and in the better class of specialized stores this factor of color is of considerable importance but in the small store or shop it is often not considered. Color matching is getting to be considered of more importance than formerly and a color matching device is now on the market which passes the light from an incandescent or arc lamp through absorbent glass screens of different qualities and colors. This subtractive method screens out to a considerable extent the excess of color rays and produces a spectrum which corresponds very closely to that of ordinary daylight.

But in the average store color lighting is not yet of importance, customers preferring a store which is cheerful and inviting with a light which is a compromise between daylight and the average night illumination. It is a point to be considered that the finest and most expensive goods purchased will, for the most part, be used at night under conditions of illumination very similar to those under which they are purchased. Therefore it may justly be argued, why should we not sell goods under the conditions under which they will have the most critical use. Aside from the use of daylight illumination for matching purposes this argument will doubtless continue to carry much weight.

In the larger stores it has come to be considered a necessary practice to have a certain portion or corner however where an artificial light equivalent to daylight is available for matching delicate shades of silks, ribbons, etc., which will be worn under different lighting conditions. This is also necessary for distinguishing colors which are more or less similar, as blues, dark greens and blacks. For this purpose a color matching device mentioned above is coming to be used fairly extensively. The mazda lamp has been pretty uniformly adopted for store lighting on account of its availability in small units even though its efficiency is not so great as that of arc lamps. Under certain conditions however, the arc lamp is giving most excellent results and is giving a color effect as near to daylight as has yet been obtained. Sometimes the tungsten lamp is used at different intensities in different parts of the installation, as for instance, in the jewelry department where a brilliant light is desirable the lamp is run above its normal voltage, and in the furniture department where a light tending to red is desirable, the lamps are operated at low voltage.

Diffusion

Glaring sources of light should be distinctly avoided, even though in securing proper effects there is a considerable loss of total light. The gain in the ability to see properly usually off-sets this loss. The lighting scheme should be such that neither the light sources nor the effects produced will be injurious or objectionable to the eye. Proper diffusion is now being obtained by the use of various kinds of reflector and diffusing glassware in both direct and indirect adjustments. Best advices can probably be obtained by the use of semi-indirect lighting though this is often at the expense of a considerable loss in efficiency.

Even Distribution

Proper distribution is one of the essential factors in the design of a lighting installation for a store. Deep shadows must be avoided and all places where goods are on display should have an equal share of the total amount of light. This can be accomplished only by proper spacing, height and choice of lamps and reflectors. The methods of determining these conditions are becoming pretty well understood but are sufficiently important to justify consultation with a properly qualified illuminating engineer before the lay-out is decided upon.

The Ohio Brass Company of Mansfield, Ohio, was recently awarded a contract by the Boston Elevated R. R. Co. for 610 automatic air connecting coupler and draft gear equipments for heavy subway and elevated train service.

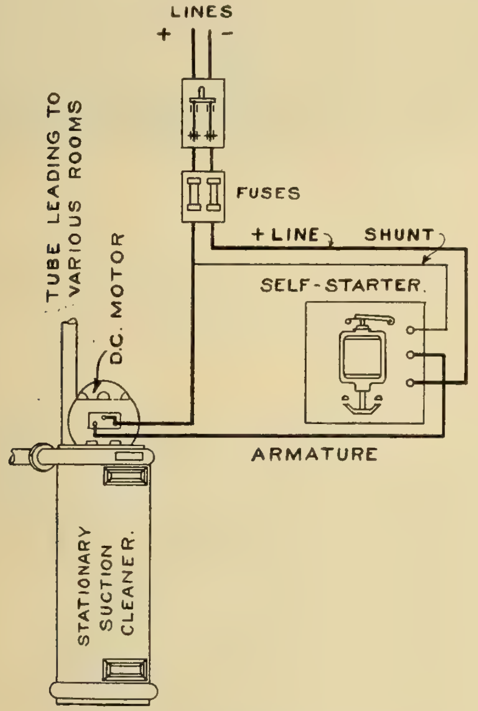
The Zorra Telephone Company, Limited, has been incorporated with a capital of $6,000 to carry on the general business of a telephone company, with head office at Embro, Ont., The provisional directors are G. A. Munroe, Jas. Crang, farmers of the township of West Zorra, and Dr. R. H. Green, Embro, Ont.

At a recent session of the Board of Grain Commissioners of Canada held at Vancouver, representatives of the B.C. Electric Railway Company and the Western Canada Power Company submitted estimates outlining the probable cost of supplying power for the operation of grain elevators at the Coast. It was pointed out that each elevator would require 1500 horse-power. Following a discussion as to the load factor, the continuity of the power, etc., the representatives of the two companies were requested to submit estimates to the board at its headquarters at Fort William, Ont.

The Dealer and Contractor

Control of Stationary Suction Cleaners

The accompanying illustration shows an installation of a motor driven cleaner and the wiring necessary using a single step self-starter. These self-starters are designed for use in connection with a double-pole main line switch, as shown in the drawing, for starting small motors of a capacity from ¼ to ¾ of a h.p., 115 and 230 volts. This particular self-starter is provided with a single step of starting resistance which is cut out automatically by the action of the self-starter solenoid when the motor has attained approximately one-half its normal speed. Being automatic in operation these self-starters will be found suitable for use in many other cases in connection with devices operated by small motors. The overall dimensions of the self-starter are about 6 in. x 7 in. The double pole switch may be placed at any point most convenient to the person who will be operating the cleaner.



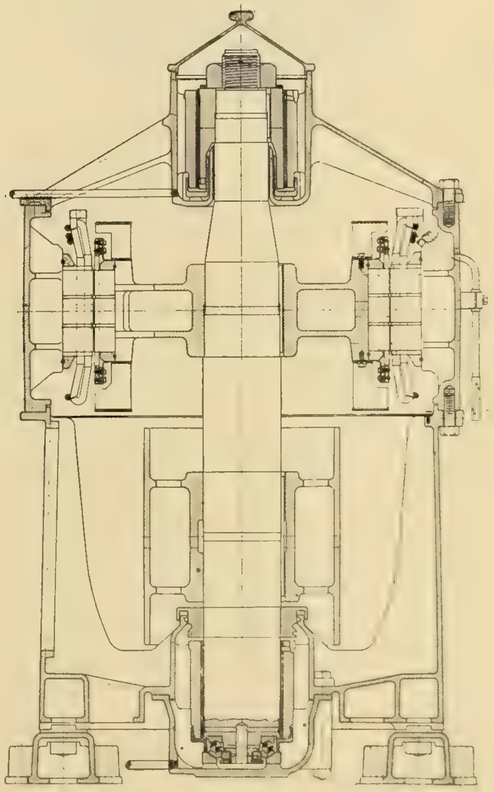
Motor controlled by single-step self-starter

"Made in Canada" Lamps

The entire "Made in Canada" train, which is to tour the Dominion, is lighted with the "Nulite" tungsten lamps of standard 60 watt, 115 volt type manufactured by the Canadian Tungsten Lamp Company, Limited, of Hamilton. This exhibit will enable all who are interested to judge the durability of the Nulite drawn wire continuous filament tungsten lamp and will create much interest throughout the Dominion, as it should prove conclusively the adaptability of tungsten lamps to places where they are subjected to severe and prolonged vibration. Dealers who are contemplating placing their contracts for the coming season will do well to make an inspection of the lamps on this train and assure themselves of their high quality.

A New Vertical Motor for Cement Mills

To provide a thoroughly satisfactory drive for vertical machinery (such as grinders and pulverizers) in cement mills and other places where the service is very severe, the Westinghouse Electric & Manufacturing Company have built a line of specially designed vertical motors in sizes varying from 75 to 200 h.p., for both direct and alternating current circuits. The special feature of this motor is its strong, rugged construction. The motor frame is supported by a massive cast iron base, which rests on slide rails with belt-adjusting screws. The shaft is of very large proportions and the bearings are designed to withstand the severest stresses. The weight of the motor and the major part of the horizontal thrust due to belt tension are carried by a ball bearing mounted within the motor base. This bearing is housed in an iron case and can be easily removed if the necessity arises. The bearings are automatically oiled, the oil being forced between the bearing surfaces whenever the motor is in motion. The ball thrust bearing runs immersed in oil. The

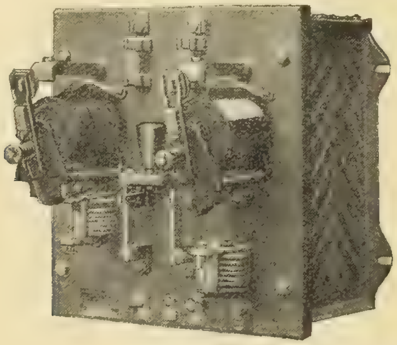


Vertical type cement mill motor

pulley is mounted inside the thrust bearing, which, together with the strength of the shaft and the rigid support afforded by the motor base, insures the elimination of distortion due to the belt tension, so that the proper clearance is always maintained between the stationary and rotating parts. The commutation of the direct current motor is practically sparkless, so that brush renewals are rarely required and commutators are long lived. The principal features of construction are shown in the accompanying illustration.

New Cutler Hammer Automatic Motor Controller

For the automatic starting of motor-driven machine tools, pumps, fans, etc., it is only necessary to close the knife switch which is mounted between the two solenoid switches on the automatic starter shown in the accompanying illustration. With this type of series relay self starter, made by the Cutler-Hammer Manufacturing Company, of Milwaukee, the resistance is cut out of circuit and the motor automatically accelerated, the starting current, however, being kept below a safe maximum value. The magnetic switches close in succession controlled by the motor current through the relays. These relays are quick and positive in action so that when the motor starts under light load it will be accelerated quickly while, if under heavy load, the resistance is cut out more slowly, but in all cases the current to the motor is kept to a safe value. Where the load driven varies this type of starter is especially adapted as there is no danger of the operator damaging the motor or machine through improper starting—he is relieved of all responsibility and needs only to close the switch and the starter does the rest. This type of automatic controller is made in capacities up to 15 h.p., 230 and 500 volts and up to 7½ h.p. for 110 volts.



Automatic Motor Controller

A similar type with the same kind of new magnetic switches is also made having a main line magnetic switch with blowout, in place of the knife switch, which allows control from a push button, float switch or pressure regulator. The use of a main line magnetic switch allows the use of controllers of large capacities, the latter being placed out of reach

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Mr. Irving Smith announces his change of address from 406-407 St. Nicholas Building, Montreal, to Room 809 of the new Unity Building, corner Lagauchetiere and St. Alexander streets where he will still continue carrying on a manufacturers' agency business of electrical apparatus and specialties.

The 36th convention of the National Electric Light Association will be held in Chicago on June 2, 3, 4, 5 and 6. Special rates have arranged with most of the railways leading to Chicago. The association has issued a pamphlet giving the approximate railway rates from various points in the United States, and Montreal, in Canada. Mr. G. W. Elliott, 29 West 39th street, New York, is chairman of the Transportation Committee.

Largest Commercial Switchboard

Our illustration shows the largest commercial switchboard in Canada, which has just been installed in the Windsor Street Station of the C. P. R., Montreal, by the Bell Telephone Company. The switchboard is of the No. 4 lamp signal multiple board type, with developments to suit the peculiar conditions of the C. P. R. Company. It is of the latest design, with lamp line signals, audible busy tests, and lamp disconnect signals. Although eight operators are now engaged in handling calls, the switchboard has a capacity for ten positions. The board is divided into two sections, the first four positions handling originating business and the other four the incoming business. Each position consists of two panels, making sixteen for the whole board.

Switchboard in C. P. R. Windsor Station

The capacity limit is 1200 local lines and 160 trunk lines; at present the board is wired for 500 local lines and 100 trunk lines, of which 225 local and 50 trunk lines are now in use. These, however, are to be increased by 50 and 40 respectively.

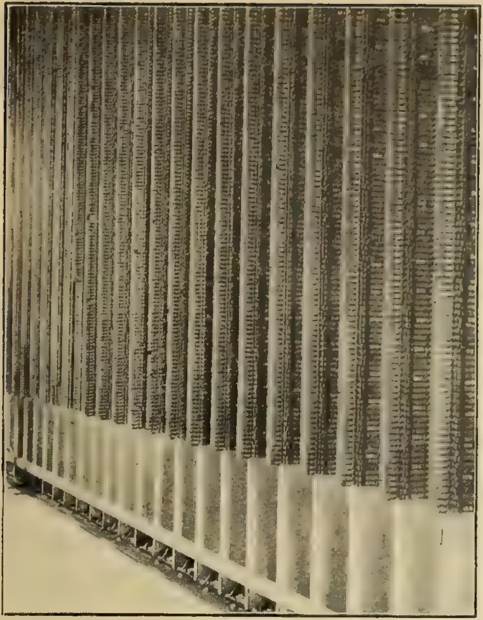
The telephone room is located in the tower of the old portion of the station, where the company have also provided a rest room for the operators.

Selling "Service" with Electric Trucks

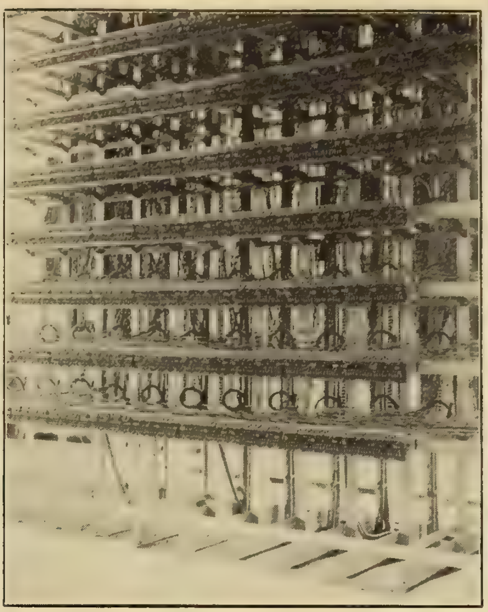
A Hartford, Conn., dealer has introduced a novel method of selling service with electric trucks. The method consists in selling the vehicle without a battery and charging the owner of the vehicle a certain rate for battery service. This arrangement is made more easily possible in that the dealer is closely associated with the local electric light and power company.

Under the provisions of this battery service contract the user may, if he wishes, operate his car twenty-four hours a day, the company providing another battery when the first runs out. In the case of cars doing a big mileage, two changes are frequently made in one day. The charge is based on mileage. For example, a 750 lb. car is supplied with battery service at 5½c. per mile provided it is operated 500 miles per month. If the car runs 1,500 miles the charge is 3c. and for 2,000 miles 2.6c. per mile.

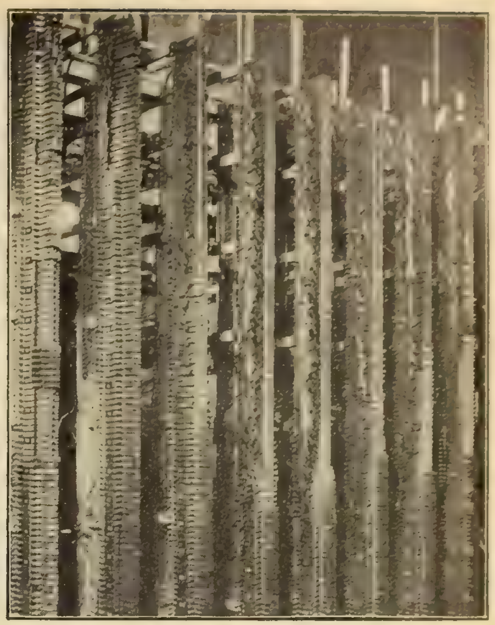
The advantage to the truck owner is that he always has battery service. Instead of boosting at certain hours he now runs around to the station and takes on another battery. On a 1,000-mile basis it is calculated that the truck owner saves $12 a month, assuming current at 4c. In this particular case Edison batteries are used.



As main frame should look, B. C. Tel. Co.



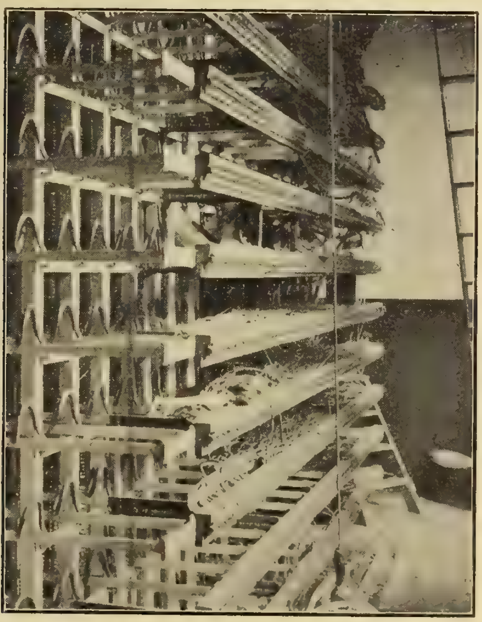
As main frame should look



Destroyed by short circuit

Switchbord Troubles

The New Westminster Exchange of the B. C. Telephone Company was severely handicapped recently when the wires of the main frame were completely destroyed by a short circuit. Occurring early in the morning when the office staff was smaller than at any time during the day, the fire which followed gained considerable headway before the arrival of the city fire brigade. It was eventually ascertained that one of the drop wires became crossed with an overhead trolley wire, and the 500 volt current came into the exchange over a cable pair. The high voltage came through the pothead and cable to the horizontal side of the main frame through the jumper wire to the protector, which it operated. The heavy current caused an arc which jumped to ground on the frame and protector, and maintained a flame which could not be conquered by sand or fire extinguishers.



Destroyed by Short Circuit

The entire main frame with the exception of the iron work was destroyed. Owing to existing conditions, officials had to turn in to repair the damage, and by continuous and excellent work complete service was resumed in less than a week.

New Companies

The Renfrew Electric Manufacturing Company, Limited, has been incorporated with a capital stock of $50,000 to carry on business as machinists, foundrymen, manufacturers and dealers in electric machinery, etc., with head office at Renfrew.

The Sangamo Electric Company of Canada, Limited, has been incorporated with a capital stock of $50,000 to carry on business as manufacturers, importers, exporters, etc., with head office at Montreal.

The Silver River Power Company, Limited, has incorporated with head office, Vancouver.

New Books

House Wiring.—By Thomas W. Poppe, electrical engineer and contractor. The Norman W. Henley Company, New York, publishers. This is a treatise describing and illustrating up-to-date methods of installing electric light wiring. It is intended primarily for those who are desirous of obtaining a practical knowledge of the subject. Only practical examples of work are included and the matter is treated in a simple, non-technical way. The illustrations used help to make the various operations clear. This work should prove of special value to apprentices, helpers, and electricians, and even the advanced electrical worker will find a number of labor and time saving suggestions which he can utilize. The book is convenient pocket size, price 50c.

Electric Arcs—By C. D. Child, Ph.D. The D. Van Nostrand Company, New York, publishers. Price $2 net. This is a compilation of experiments on arcs between different electrodes in various environments, with explanatory notes. Special attention is paid to the explanation of the arc phenomena and to recent investigations such as experiments on the mercury arc. A few pages are given to photometry and to the whistling arc. The writer has endeavored to keep in mind the needs of investigators who may come after, and references have been given to important articles on the subject. The illustrations and type are both excellent.

Bell Electric Motor Co.

The Bell Electric Motor Company of Garwood, N.J., announce that they are constructing two modern fireproof factories, steel and concrete construction, about 200 feet long, to be used with their present factory buildings, as soon as they are completed. These buildings are expected to be complete in about three months' time. Special attention has been given to securing perfect daylight by means of windows running the entire length of factory. Also special attention has been given to the installation of up-to-date testing apparatus by means of which they will be enabled to generate single phase, two phase and three phase current of all commercial voltages. There is also an extra railroad siding being run to connect these factories with their other factory buildings. The company announce that their sales of Bell single phase motors have doubled during the past year.

Century Fans

A descriptive bulletin has just been issued by the Century Electric Company, descriptive of their alternating current fans. These include desk and bracket types, four blade, operating on cycles from 25 to 133, and in sizes from 12-in. to 16-in; residence type fans, six blade, for 40, 50 or 60 cycles; and ceiling fans, four blade, 25, 30, 40, 50 and 60 cycles; types other than those included in the above are made to special order. The cut shown herewith represents one of their 58-in. ceiling fans. It consumes 140 watts operating 240 r.p.m. at 60 cycles. The motor is induction type so that there are no moving contacts. The fan blades are made of carefully selected kiln-dry material. It is not necessary to disconnect any wires to take off the oil cup and bearings or to take out the armature for cleaning unless the fan is fitted with electroliers. The oil cup is specially arranged to carry electrolier arms, however, as shown in the illustration.

Combination 58 inch fan and electrolier

Insulated Aluminium Cables

The Paris Omnibus Company has placed an important contract for aluminium armored cables for tramway feeder networks. The cables will have cross sections up to 1,000 square millimeters (1.55 square inches), and are for a pressure of 500 volts. The order comprises some 300 tons of metal, and is expected to show an economy of 8 to 10 per cent. as compared with the cost of copper cables. Including cables already installed of a net weight in aluminium of about 300 tons, there are in service, or on order, insulated cables employing a total of 600 tons of aluminium in this company's system.

Free Renewals of Tungsten Lamps

The Hartford Electric Light Company has instituted the policy of giving free renewals of tungsten lamps in sizes of 60, 100, 250, 400 and 500 watts. This offer is restricted to one renewal per socket per year. Renewals are not made, however, for the 25 and 40-watt sizes, but a charge of 20 cents each is made for 40-watt lamps and 40 cents for 25-watt lamps.

New Ottawa Exchange

Work on the building of a new telephone exchange for Ottawa is to commence forthwith. This will give Ottawa two branch exchanges and the new one will be known as the "Carling." The contract for the switchboard has been let to the Northern Electric & Manufacturing Company and will have an ultimate capacity of 8,800 subscribers. It is proposed to have the new exchange in operation early next year. The site for the building is on the corner of Carling avenue and Bank street. The opening of the new exchange will involve a number of alterations to the present Central and Rideau exchanges.

Underground in Hamilton

Following a recent decision of the Dominion Railway Board all companies using wires on the main streets of the city of Hamilton will place these in underground conduit. The date by which all this work must be completed is July 15, 1913. By the decision the Bell Telephone Company are allowed to use their own conduits, but the municipal distributing system, the Hamilton Electric Light Company and the telegraph companies will use a conduit system to be installed by the municipality and for which rent will be paid. The amount of the rental will be fixed later by the Dominion Railway Board.

Light and Power in Dorval

In connection with a scheme for converting Dorval Island, on the River St. Lawrence, P.Q., into a residential district, plans have been drawn up for an installation of power and house lighting and of tungsten street lighting. Power is to be taken from a power house in Dorval, current being supplied by the Montreal Light, Heat and Power Company, and brought down on poles to the water front. From there, by means of a submarine cable, power will be conveyed to the island, where a receiving station will be constructed. The power taken from Dorval is three-phase, 60-cycle, 2200 volt. The street brackets will be Hubbell No. 999 Schedule T tungsten street fixtures. Eight single-phase lighting transformers 2200-1100 volt and secondary voltage of 220-110 will be required. For pumping sewage two centrifugal pumps motor-driven, together with the necessary transformers, will be installed. Dupont, Roy and Baudouin, Montreal, are the engineers for the Dorval Island Park Company.

Relief from Congestion

As the result of a conference with the Board of Control, the directors of the Montreal Tramways Company have made proposals for relief of the congestion on the system. The proposals are intended to give immediate relief only, and the company suggest that permanent and elastic plans should be later drawn up to provide for the future growth of the city. In order to give an increased service in the down-town district, the company ask permission to re-route several lines. Also to relieve the north-eastern section a number of new routes are suggested. The plans also provide for three new routes which would give accommodation for the St. Catherine street traffic. The elimination of stops at unimportant points would assist in giving a faster service. These changes, the directors state, would enable the company to add further 200 cars over and above the 200 cars now being delivered. The use of Victoria Square as a turning point for some lines is an essential part of the proposals. The company intend to order 100 cars from the United States, owing to the difficulty of securing quick delivery from Canadian firms.

D. D. YOUNG VICE-PRESIDENT
A. J. T. TAYLOR PRESIDENT
G. L. KIRK SECRETARY & TREASURER
G. H. JERNBERG Pumping & Power Plant Equipment
R. H. MURRAY Logging & Hoisting Equipment
A. H. FULTON Marine Gas Engines
E. G. TAYLOR Marine Construction & Repairs
TAYLOR & YOUNG LIMITED.
ANGELL ENG CO

A Vigorous Western Firm

The business of the firm of Taylor & Young, Limited, shown herewith, is principally a combination of general consulting engineering with the sale of heavy machinery including pumping, power plant and machine shop equipment. The firm have been careful in organizing a well-balanced staff and in selecting the manufacturers they represent and as a result have been able to demonstrate the desirability of a combination between practical engineering and the actual selling of machinery. The company have paid a good deal of attention to hydraulic engineering and especially to centrifugal pumping machinery. One of their recent contracts is a 27,000,000 gallon installation consisting of two 20 in. pumps mounted in parallel and direct motor driven, which is said to be the largest pumping installation in British Columbia.

THE JOVIAN ORDER CO-OPERATION

On Saturday, May 3rd, a rejuvenation of the Sons of Jove was held at Cooper's Restaurant, Montreal, when 63 new members were initiated. Among the prominent candidates were: Messrs. R. F. Jones, manager, Bell Telephone Company; J. A. Baylis, engineer, Bell Telephone Company; W. H. Winter, general plant superintendent, Bell Telephone Company; R. W. Logan, general contract agent, Bell Telephone Company; A. S. Byrd, superintendent of power plants, Montreal Tramways; A. Gaboury, superintendent Montreal Tramways; J. R. Meadowcroft, manager, The Garth Company, and J. J. York, engineer, St. Lawrence Sugar Refineries. Several out-of-town Jovians were present, the total attendance being 125. A pleasant feature was the presentation of umbrellas to Messrs. Carrol, Turnley and Campbell, the members of the Membership Committee, to whose efforts the success of the Rejuvenation was largely due. Speeches were made by Mr. W. J. Doherty, statesman-at-large, and Mr. James Bennett, statesman for the province.

Another Rejuvenation is planned for the near future, to accommodate a number of those interested in the electrical industry whose applications for membership did not reach the committee in time for consideration on this occasion.

Trade Publications

J-M Products—Folder issued by the H. W. Johns-Manville Company, containing a list of their many asbestos, magnesia and electrical products. A detachable post card forms part of the folder, by the use of which the customers' wants may be made known.

Car Heating—Catalogue issued by the Parker Car Heating Company of Detroit, Mich., and London, Ont., descriptive of the Parker Anti-freezing and hot water system of railway car heating by steam. The catalogue is well illustrated and represents an interesting treatise on the subject.

Sub-Station Data Sheet.—The Delta-Star Electric Company, Chicago, are distributing a data sheet showing the cost per kw. of sub-station equipment for commercial voltages from 13,200 to 33,000 volts. This data sheet will be of service to managers called upon to make quick estimates.

Electrical Slide Rule—A pamphlet issued by Keuffel & Esser Company, New York, describing the Roylance Electrical Slide Rule. The Roylance is a modification of the regular Mannheim Slide Rule having, in addition, a series of scales or gauge marks by means of which the different properties of copper wire such as size, conductivity, weight, etc., may be determined without the use of tables. Other special features are embodied in this rule.

Current News and Notes

Armstrong, B.C.

A 200 h.p. Diesel engine and 150 kw. generator have just been placed in operation by the municipality. The plant was installed by Mather, Yuill & Company. The original system in Armstrong consisted of a small Pelton water wheel driving a 100 kw. C.G.E. 3-phase, 60-cycle generator. 32 candle power carbon lamps are used on the streets. The new generator is the Swedish General Electric type.

Aurora, Ont.

A by-law will be submitted to the electorate early in June authorizing the town council to close a contract with the Toronto and York Radial Railway Company for the supply of energy necessary to feed the municipal light and power lines.

Brandon, Man.

Further debentures to the amount of $100,000 will be issued to complete the construction of the street railway system. This will bring the total of debentures issued for this purpose to $400,000. 6½ miles of track have already been laid and it is proposed to add two more miles.

Two of the street cars for the municipal street railway system which are being assembled in Winnipeg are expected to arrive in Brandon some time during the month of May.

By-laws will be submitted in the near future, authorizing the expenditure of $150,000 for street railway extensions and $26,618 for street lighting equipment.

Brantford, Ont.

There is a movement towards the purchase, by the municipality, of the privately owned railway system here.

Brockville, Ont.

The Bell Telephone Company will probably build a new exchange here during the year. The increase in the number of telephones in the last three years has been very marked, as is indicated by the following figures: In 1909 there were 465 telephones, in 1911, 525, and at the present time, 664.

Calgary, Alta.

The Calgary Water Power Company are installing two 150 h.p. turbines manufactured by the William Hamilton Company of Peterboro.

The Canadian Vickers, Limited, are at present installing, for the municipality, a 2500 kw. 3-phase, 2300 volt, 60-cycle, 1800 r.p.m. generator to be driven by a Bellis & Morcom turbine. The generator is the Vickers, revolving field, self-ventilating type.

The Bonness Investment Co. of Calgary will receive tenders up to May 31, for two a.c. generators, exciters, a spare motor-driven exciter, six panel switchboard, tungsten lighting system, transmission lines and underground cable. The generators will be driven by two vertical multi-cylinder internal combustion engines.

Chatham, Ont.

The Hydro-electric Power Commission of Ontario has submitted rates to the city of Chatham for the supply of 1200 h.p. at 13,200 volts. The estimated cost of a power and lighting distribution system including sub-station building and equipment and the necessary 13,200 volt line from the Commission's transforming station is $67,308; cost of multiple street lighting system including a certain amount of underground work with the necesary lighting standards, $14,264; engineering and contingencies, $8,157; total, $89,729.

Dawson, Man.

The power house of the Dawson Electric Light & Power Company is reported to have been completely destroyed by fire.

Dryden, Ont.

The municipality of the town of Dryden has purchased a water power property in the township of Wainwright.

A by-law was carried on May 3, authorizing the establishment of a telephone system in this town.

Edmonton, Alta.

It is reported that arrangements have been made by the directors of the Edmonton, Stony Plain and Wabamun Electric Railway Company to commence the construction of their road starting at the western city limits of Edmonton. This company has a charter for operating a line between Edmonton and Wabamun, a distance of 45 miles.

The North Edmonton Civic Association is urging an extension of the municipal street railway system along the Fort Saskatchewan trail through North Edmonton to the Belmont school. It is proposed to operate this extension with storage batteries which can be charged during the early morning hours when the load on the municipal plant is a minimum.

At a recent meeting of the city council, a number of aldermen expressed their dissatisfaction with the financial progress of the street railway system and the following resolution was carried. "That the city commissioners report as to why the street railway is not paying and what they propose to do to make it pay. And that they be asked to remedy the acute traffic conditions by putting on more cars during the noon and evening hours; and that they be asked, if possible, to have the cars run faster."

Englehart, Ont.

On May 4th, the entire business section of the town of Englehart was wiped out by fire including the Englehart-Charlton Power Company.

Estevan, Sask.

The municipal generating plant at present consists of a 125 kw. 60-cycle, 3-phase, 2250 volt steam engine driven Canadian Westinghouse generator. The municipality contemplates doubling the plant capacity in the near future.

Ethelton, Sask.

The Ethelton Telephone Company has applied for incorporation and will require materials of all kinds, poles excepted.

Fernie, B.C.

Three miles of additional pole line will be constructed through the residential districts. The city's electrical requirements will also include automatic voltage regulators and a switchboard integrating wattmeter.

Fort William, Ont.

It is considered likely that more rolling stock will have to be purchased in the near future. Recently an order was placed with the Ottawa Car Company for twelve cars, four of which have been received.

The city council has awarded the contract for 7,000 feet of 18 in. cast iron pipe to the Canadian Iron Corporation, Limited, of this city, The Canadian General Electric Company have been awarded the contract for a 500 kw. motor-generator set.

Galt, Ont.

The Hydro-electric System is growing very rapidly, having increased from 456 services in June, 1911, to 1,200 at the present time. Power has grown during the same time from a connected load of 20 h.p. to one of 830 h.p.

Gore Bay, Ont.

The Manitoulin Island Rural Telephone Company are increasing their capital stock from $2,000 to $7,000 and will extend their line through a number of townships.

Greensville, Ont.

Plans are being prepared for the extension of the Dundas hydro-electric system to this place.

Grimsby, Ont.

The Grimsby Electric Car Company have purchased a site here, and contemplate the erection of a $25,000 factory.

Hagersville, Ont.

The Hydro-electric Power Commission of Ontario are building a small transformer station here in which they will install, about 300 h.p. capacity in Westinghouse transformers.

Halifax, N.S.

The railways committee of the Nova Scotia legislature has reported favorably on the bill which enables the Halifax Tramway Company to increase its capital to $5,000,000. At the same time the city of Halifax bill giving power to submit the question of municipal ownership to the citizens was thrown out. Following this action the mayor called a public open air meeting of protest.

Hamilton, Ont.

Tenders are received up to May 14, for three 500 kw. transformers with switching equipment.

Tenders have been called by the municipal electrical department for 700,000 ft. of underground conduits.

It is expected that the plans of the underground conduit system will be approved about the first of June, and that work will commence immediately thereafter.

The city has two gangs grading the base line east of Irondale preparatory to the laying of rails along this street by the local street railway company. It is hoped to have a street car service between Irondale and Kenilworth avenue some time during the early summer.

Kamloops, B.C.

Tenders will be received up to June 12, by DuCane, Dutcher & Company, Vancouver, for water wheels, generators, switching equipment, etc., for the new plant being installed here.

Kenora, Ont.

The Keewatin Power Company is reported to have been taken over by Mr. Backus of Fort Francis fame. It is further understood that if the purchase of certain timber limits now under construction is completed, a large power development will be carried out at this point. 9,000 h.p. is mentioned which would provide sufficient power for a 100-ton pulp mill.

Kingston, Ont.

An estimate has been submitted by the Hydro-electric Power Commission on the cost of an underground conduit system for the down town section. The question of submitting a by-law to the people to cover the expense of this work is being considered.

Lachine, P.Q.

Tenders will be received up to May 12, for material for an electric lighting system in this town. V. H. Dupont is engineer-in-charge.

La Salle, P.Q.

The town of LaSalle, P.Q., has granted a lighting franchise to the Montreal Light, Heat and Power Company.

Lethbridge, Alta.

Line extensions to the cost of approximately $10,000 will be required in the near future.

London, Ont.

Following a rate war between the London Electric Company and the city hydro-electric department, the lighting rate to the different churches has been reduced to 3c per kw. hour.

The Court of Appeal has given judgment in favor of the right of the London & Lake Erie Transportation Company to operate its cars on Sunday. This is an appeal from a recent finding of Chancellor Boyd, which was unfavorable to the railway company.

Long Reach, N.B.

The Kingston Peninsula Telephone Company, Limited, has been incorporated to build and operate a telephone system in the county of Kings, N.B.

Medicine Hat, Alta.

A vote will be taken on May 22, authorizing the council to sign a franchise agreement with the Montreal Engineering Company for the installation of a street railway system in Medicine Hat. The agreement gives the company a 20-year franchise renewable every five years. The company agree to commence work within three months from the final passing of the by-law and to finish three miles of railway within nine months, a further three miles within twelve months and a further three miles within twenty months; the whole provided the necessary material can be obtained in time.

Montreal, P.Q.

The American Light, Heat & Power Company of Canada, Limited, has been incorporated.

La Societe d'Eclairage et d'Energie Electrique du Saguenay, Chicoutimi, has been incorporated in Quebec with a capital of $3,000,000.

Tenders will be received after May 14, for wire and cable to the value of approximately $100,000, to be used in the underground installations.

The Montreal sales offices of Canadian Allis-Chalmers, Limited, have been removed from the Canadian Express building to 162 St. Antoine street.

At the Angus shops of the C. P. R., it is estimated that twenty or more electric motors ranging in capacity from 5 to 50 h.p. will be required in the near future.

The business of Mr. W. N. Dietrich, electrical contractor and engineer, Montreal, has been incorporated under the name of Dietrich, Limited, with a capital of $50,000.

By voluntarily increasing the pay of the motormen and conductors one cent per hour, the Montreal Tramways Company will add over $100,000 per annum to the wages bill.

The Montreal Light, Heat and Power Company propose to again reduce the price of electric light, although the directors have not yet decided on the amount. The present price is 7c per kilowatt hour.

Two Montreal electric companies have been granted Federal charters—Fred Thomson Company, Limited, with a capital of $100,000, and the Electric Repair & Contracting Company, Limited, with a capital of $50,000.

At the recent annual meeting of the Maritime Coal, Railway and Power Company, Limited, the president reported that contemplated extensions during the coming year would include enlargements to the power plant at Chignecto and the electrification of the colliery plant at Joggins Mines.

Nanaimo, B.C.

The Nanaimo Electric Light, Power & Heating Company, Limited, expect to commence running a day load this autumn.

Newmarket, Ont.

It has been arranged that the Hon. Adam Beck will address the rate payers here on May 22, and explain the point of view of the Hydro-electric Commission. A vote takes place on May 30, as to whether a contract shall be made with the Toronto and York Radial Railway Company, or with the Hydro Commission.

Niagara Falls, Ont.

The transformer house of the Ramapo Iron Works was recently destroyed by fire.

North Battleford, Sask.

The installation has just been completed of a Bellis & Morcom, three-crank, compound, 750 h.p., engine and a 600 kw. Canadian Westinghouse generator. Additions to the power house costing approximately $11,000 are at present under construction.

North Bay, Ont.

An organization known as the United Board of Trade of New Ontario has been formed to include representatives from Sudbury, Sault Ste. Marie, North Bay, Sturgeon Falls, Callender, Blind River and Thessalon. The organization proposes to confer with the Hydro-electric Power Commission of Ontario in the matter of water power developments in the North land.

Norwood, Ont.

It is the intention of Mr. W. C. Harrison, owner of the Norwood electric light plant, to increase his generator capacity by the addition of a 50 or 60 kw. generator some time within the present year.

Ottawa, Ont.

The railway committee has approved a bill providing for the construction of an electric line from Brantford to Galt, passing through the townships of Brantford, Lancaster, Beverly, South Dumfries and North Dumfries. This is an extension of the system of the Brantford and Hamilton Electric Railway Company.

Outremont, P.Q.

The Outremont, P.Q., Town Council have decided to carry out the construction of underground conduits on the principal streets of the town. The scheme has been drawn up by Prof. L. A. Herdt, of McGill University, after consultation with the Bell Telephone Company. The work will be under the supervision of Prof. Herdt, but half of the cost will be borne by the telephone company, who will own a portion of the system. The conduits will be constructed to allow separate conduits for the company and for the town, with a dividing wall as common property. The work is to be done as soon as possible, as the company will soon have a new exchange ready for business in this district. The cost is estimated at $100,000, the work being let by tender. The conduits will be built on one side of the road.

Peterboro, Ont.

It is understood the Hydro-electric Power Commission will report against any extensive underground distribution system in the city of Peterboro.

Pointe-aux-Trembles, P.Q.

On conditoin that five cent fares are given, the council of Pointe-aux-Trembles, P.Q., will grant a franchise for forty years to the Montreal Tramways Company. The agreement is subject to ratification by the Provincial Legislature.

Port Arthur, Ont.

Tenders will be received up to May 19, for three motor-driven centrifugal pumps, 2,000 gallons capacity, with necessary auxiliary equipment.

Port Dover, Ont.

A by-law was recently passed authorizing the construction of a municipal telephone system at an expense of $40,000.

Prince Rupert, B.C.

A by-law for the installation of a complete new distribution system will be voted on in the near future.

Quebec, P.Q.

The Dorchester Electric Company have been awarded a contract for the lighting of Battlefields Park. 78 standards will be required in all, 34 carrying a single 250 candle power tungsten and 44 carrying a group of tungstens. All the wiring will be underground.

Tenders are being called for the construction of a new dry dock at Levis. For emptying the dock, three motor operated centrifugal pumps each having a capacity of 60,000 gals. per minute will be used. The current will be furnished by three steam turbo-generators of approximately 500 h.p. capacity each. These will supply power to the motors operating the pumps and for motors used for other purposes in connection with the operation of the dry dock. The total cost of the dock is estimated at anywhere between $4,000,000 and $5,000,000.

Revelstoke, B.C.

Contemplated additions to the Municipal light and power system include 1½ miles of 3-phase transmission line, a 1400 h.p. water turbine, a 750 kv.a. generator, a Tirrill regulator and switchboards, as well as a quantity of tungsten street lighting equipment.

Saskatoon, Sask.

An order has been placed with the Preston Car & Coach Company for six double truck cars for use on the Saskatoon Municipal Railway System. This order will be duplicated if the by-law covering the extra cost is passed by the rate payers. A number of extensions to the system are planned for the present year.

The Gratias Land Company have made an offer of a $5,000 cash contribution towards the construction of an extension to the present May Fair route. The extension suggested would be about 1¼ miles and is calculated to cost $16,000. The Land Company also agree to erect 150 workingmens' homes which they will rent at a reasonable figure.

South Edmonton, Alta.

The Leather & Shoe Company contemplate the installation of an isolated plant to supply light and power in their factory.

St. John, N.B.

On May 8th the International St. John River Commission resumed their sittings to take further evidence on the question of the effect of a hydro-electric plant at Pokick Falls on the navigation of the St. John River. It is understood that a report will be made to the government on the whole situation during the coming summer.

St. Thomas, Ont.

Street railway returns for the month of April totalled $1,430, as against $1,113 a year ago. The number of passengers carried was 38,257, as against 31,202 during the same period last year.

Strassburg, Sask.

Tenders are called until May 20, for an electric lighting plant equipment.

Sydney, N.S.

The Cape Breton Electric Company, following a record year in earnings, have increased the dividend rate on the common stock to 6 per cent.

The Pas, Sask.

Tenders will be received to May 20 for supply and delivery of two crude-oil engines and two generators with exciters, switching, and all necessary auxilary equipment. Murphy & Underwood, Saskatoon, are consulting engineers.

Three Rivers, P.Q.

La Compagnie Hydraulique de Saint Paulin Limited, has been incorporated with head office Saint Paulin, with power to develop water falls and operate flour, grain, lumber mills, etc.

Toronto, Ont.

A bill for the establishment of a hydro-electric system serving sections of New York State and operated according to plans similar to those adopted by the Hydro-electric Power Commission of Ontario has been passed.

The Bell Telephone Company have opened a new exchange on Logan avenue in the eastern part of the city to be known as the Gerrard exchange. The switchboard has a present capacity of 2,000 telephones but is planned for an ultimate capacity of 10,000 lines.

The International Light & Power Company which was recently incorporated at Ottawa with a capitalization of $10,000,000 turns out to have been formed for the purpose of buying securities of public utilities operating in South America. It does not appear that there is any intention on the part of the company of purchasing Canadian public utilities.

The Bell Telephone Company recently made application to the Dominion Railway Board for an order to discontinue the interchange of long distance service with a number of independent telephone companies. Council for the Bell Company claimed that the independent companies were cutting into the Bell business. The evidence was taken recently in Toronto and the Board reserved judgment.

Vancouver, B.C.

The Silver River Power Company has been incorporated with head office, Vancouver, and given the usual wide powers of acquiring and developing water powers and distributing electrical energy, etc.

Victoria, B.C.

The British Columbia Electric Railway Company have at present under erection an additional 8,000 kw. hydro-electric unit at their Jordan River plant.

Walkerton, Ont.

The Walkerton Electric Light & Power Company, Limited, are at present building a new dam and power house which it is expected will be complete in June of the present year.

Weyburn, Sask.

The town of Weyburn, are at present installing two 266 h.p. water tube boilers. In the near future they will add a 500 kw. steam driven generating set.

Windsor, Ont.

A contract was recently awarded by the town council to R. E. T. Pringle, Toronto, for 125 ornamental lamp standards.

Winnipeg, Man.

Plans are drawn for the ornamental street light extension on Main street north, from the subway to the northern city limits.

The following wage scale has been agreed to between the Winnipeg Electric Railway Company and its employees: First six months, 25c per hour; second six months, 27c; second year, 28c; third year, 31c; fourth and following years, 34c.

The Woodstock and Northampton Telephone Company, Limited, has been incorporated to carry on a general telephone business in the parishes of Northampton and Woodstock and the town of Woodstock, and eleswhere in the county of Carleton.

Yorkton, Sask.

Tenders have been called for the erection of a new power house building.

MOONLIGHT SCHEDULE FOR JUNE, 1913

Courtesy of the National Carbon Company, Cleveland.

Date.	Light.	Date.	Extinguish.	No. of Hours
May 1	7 50	Jun. 2	3 50	8 00
2	7 50	3	3 50	8 00
3	7 50	4	3 50	8 00
4	7 50	5	3 50	8 00
5	7 50	6	3 50	8 00
6	7 50	7	3 50	8 00
7	7 50	8	3 50	8 00
8	7 50	9	3 50	8 00
9	7 50	10	3 50	8 00
10	10 40	11	3 50	5 10
11	11 10	12	3 50	4 40
12	11 30	13	3 50	4 20
13	11 50	14	3 50	4 00
15	0 20	15	3 50	3 30
16	0 50	16	3 50	3 00
17	1 30	17	3 50	2 20
18	No Light	18	No Light	
19	8 00	19	10 30	2 30
20	8 00	20	11 10	3 10
21	8 00	21	11 40	3 40
22	8 00	23	0 10	4 10
23	8 00	24	0 30	4 30
24	8 00	25	0 50	4 50
25	8 00	26	1 10	5 10
26	8 00	27	1 30	5 30
27	8 00	28	1 50	5 50
28	8 00	29	2 20	6 10
29	8 00	30	2 40	6 40
30	8 00	July 1	3 10	7 40

Total Hours............158 20

ELECTRICAL MACHINERY
AND REPAIRS

Armatures Complete
Armatures Rewound
Armature Coils
Armature Shafts
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Commutators New,
Refilled or Assembled

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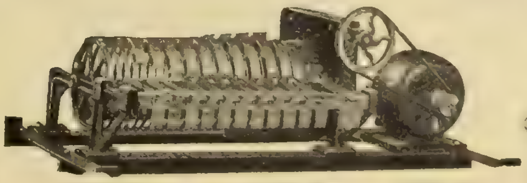

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FOR SALE

One Westinghouse type C. 100 h.p., 2000 volt, 25 cycle, induction motor, 480 r.p.m., with starting panel complete.

One General Electric type A.M. form B., 2200 volt generator, 32.6 amp., 60 cycle, 900 r.p.m., with exciter and combined generator and exciter panel complete.

First class condition, crated for shipment, Welland, Ont. For particulars apply to Hydro-Electric Power Commission of Ontario, Continental Life Building, Toronto. 9-10

FOR SALE

Tenders wanted for purchase in whole or in part of the following apparatus:—

1 20 h.p. 220 volt, 60 cycle, C.G.E. Motor, complete.
1 5 h.p., 220 volt, 60 cycle Westinghouse Motor.
2 5 h.p., 110 volt, 60 cycle, Westinghouse Motors.
1 2 h.p., 110 volt, 60 cycle Westinghouse motor.
1 Goldie McCulloch Wheelock Engine, 125 h.p., 20 x 50 x 16 x 50.
1 Laurie Corliss Engine, 90 h.p., 13 x 30.
2 Northey condensers and pumps, 8 x 12 x 12.
36 ft. 4-in. line shafting, complete with vertical shaft hangers and boxes and 2 friction clutches.
2 belt tighteners.
1 pulley, 46 x 23½.
1 pulley, 30 x 22.
2 pulleys, 19½ x 17.
1 pulley, 17½ x 72.
1 pulley, 5 x 28.
79 ft. 2-ply, 17½-in. leather belt.
61 ft. 2-ply, 16-in. leather belt.
82 ft. 19½-in. leather belt.
Approximately 100 ft. 4-in. steam pipe with valves and fittings complete.

All the above apparatus in first class shape but has been discarded owing to the introduction of Hydro-electric Power and may be seen at the Pumping Station, St. Mary's, Ontario.

H. M. MILLER,
Sec. W. L. & H. Commission.
10-11 St. Marys, Ont.

FOR SALE

100 H.P. Boiler and Engine, Watrous Engine Co., Brantford, Ont. Dynamo, Allis-Chalmer, Bullock, Montreal. Apply Town Clerk, Milton, Ont. 9-10

Wanted

WANTED—Second-hand generators. 1—60 kw., 1—150 kw., 1—120 kw., 1—200 kw., 3 phase, 60 cycle, 2200 volt machines, for belt drive, must be in good condition and by some standard maker. Box 780, Electrical News, Toronto, Ont. 9-12

A large firm manufacturing carbon brushes for all kinds of service desires good electrical or supply firm or else good salesmen to represent them in various parts of Canada. Apply Box 774, Electrical News, Toronto. 9-10

Wanted

Large United States firm manufacturing the best carbolineum wood preserver on the market is considering the advisability of making an arrangement with some concern in Canada to handle their product on a royalty basis. For particulars address Box 784, Electrical News, Toronto, Ont. 9-10

CITY OF REGINA

Sealed tenders, registered and clearly marked on the outside of the envelope, "Tender for Power House Equipment," and addressed to the City Commissioners at Regina, will be received up until noon of **May 15th, 1913**, for the supply of:—

One pair vertical boiler feed pumps; each pump's capacity to be 7,500 imperial gallons per hour.

One combined open heater and meter, capable of handling 125,000 lbs. feed water per hour.

Copies of specifications may be had from Mr. E. W. Bull, Superintendent of Light and Power, Regina, Sask. A marked cheque for five per cent. of the amount of bid must accompany each tender.

The City Commissioners reserve the right to reject any or all tenders. 9-10

Agents Wanted

WANTED—Reliable agents to handle established line of Instruments and Transformers throughout the Canadian territory. Box 785, Electrical News, Toronto, Ont. 10

Situations Wanted

Engineer, 10 years experience manufacturing and operating, seeks post as superintendent, chief operator, or local superintendent of Hydro-electric power plant. Held similar positions. Vacant June 23. Box 792, Electrical News, Toronto, Ont. 10

Technical graduate familiar with plant and switchboard design, test and manufacturing of electrical apparatus, seeks position connected with the design or construction of hydro-electric power plant, around Montreal preferred. Would like to start as designing draughtsman. Has also experience in surveying and underground construction. Speaks English and French. Best of references. Apply Box 794, Electrical News, Toronto, Ont.

Situations Vacant

Hydro-Electric operator wanted to take charge of eight hour shift, $75.00 a month. Box 777, Electrical News, Toronto, Ont. 9-10

WANTED—Man with Engineer's License, as helper in Power House. Steady employment. State experience and salary expected. Box 768, Electrical News, Toronto, Ont. 9-10

WANTED—Salesman for electric wire and cable lines. College graduate with experience as salesman preferred. Write fully giving experience, training, age and references. Box 786, Electrical News, Toronto, Ont. 10

WANTED—Recent college graduate, technical course, preferably electrical, for office position, including correspondence. Write full particulars as to training, business experience, age and references. Box 787, Electrical News, Toronto, Ont. 10

For Rent—Cottages

If you want a real holiday, plan to spend your vacation this year in Muskoka where "the breezy call of incense breathing morn will put new life in mind and body. Muskoka offers more real healthful enjoyment for less money than any other resort in the world.

Four cottages to rent $125 to $200 on Bohemia Island, less than a mile from Royal Muskoka Hotel and good Golf Links. Box 771,

Electrical News, Toronto Ont.

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in many of the great central and sub-stations in the Dominion.

Where tubing and solid bus are to be tapped they are invaluable.

Troubles due to faulty joints are eliminated, while costs are reduced by the facility and simplicity of their installation.

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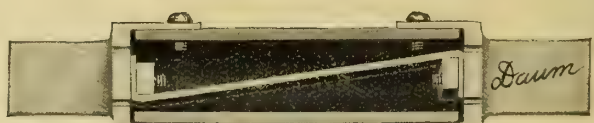

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make a nickel do a dollar's work. They save 95 per cent. of fuse expense. The shell lasts indefinitely. Commercial fuse wire bought anywhere makes a blown Daum good as a new one. There's your saving in a fuse-shell. Want it? Get a Free Sample and see for yourself. You'll see the saving. Write!

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Ammeters and Voltmeters, Wattmeters, Synchroscopes, Power Factor Meters and Frequency Meters, constitute a line of Switchboard Alternating Current Indicating Instruments which is unequalled. Send for our Catalogs giving full description of these instruments. They are accurate—durable—dependable—and we stand back of them.

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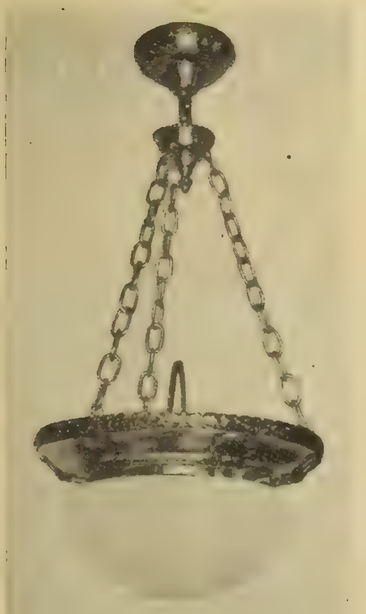
Chicago, 1504 Monadnock Blk.
Boston, 176 Federal Street.
Philadelphia, 342 Mint Arcade.
Birmingham, Brown Marx Bldg.

Detroit, 44 Buhl Block.
St. Louis, 915 Olive Street.
Denver, 231 15th Street.
San Francisco, 682 Mission St.
Cleveland, 1729 E. 12th Street.

Toronto, 76 Bay Street.

Montreal, Winnipeg, Vancouver, Calgary } Northern Electric & Mfg. Co.

London, Audrey House, Ely Place, Holborn.
Paris, 12 Rue St. George.
Berlin, Genest St. 5, Schoenberg.
Johannesburg, So. Africa, F. Peabody Rice, Standard Bank Building, Harrison St.



Nº115

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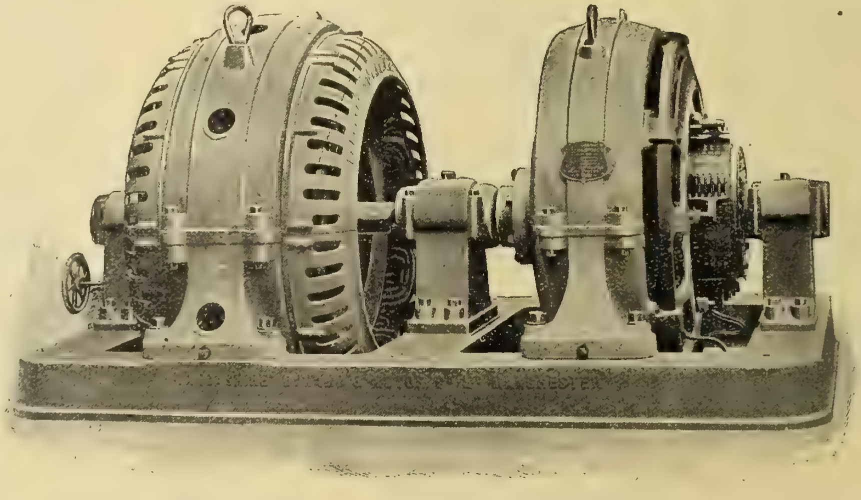

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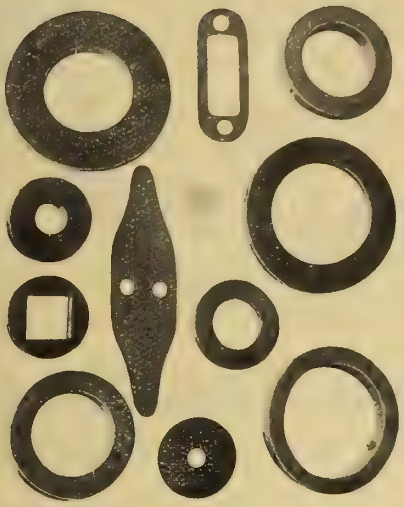

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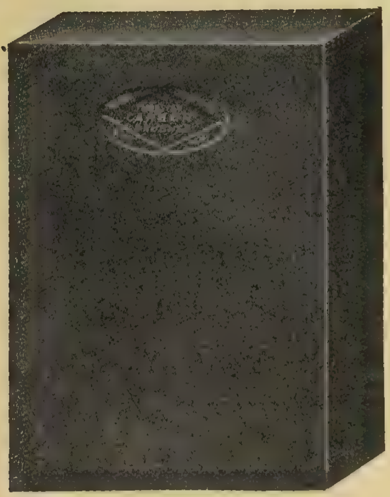
depending upon the design of the motor or generator. Further—

A Definite Degree of Abrasiveness Is Necessary in Brushes



to keep the mica insulation of the commutator flush with the copper segments.

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are classified in an entirely new way which makes it easy to select the brush best suited to your service. We classify brushes with respect to voltage, current density, resistance per cubic inch and abrasiveness——the latter under seven divisions.

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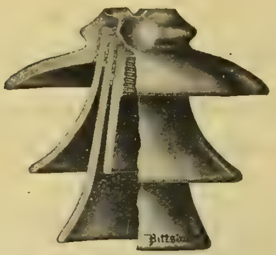

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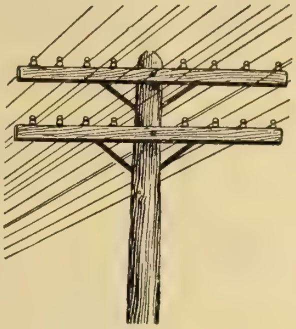

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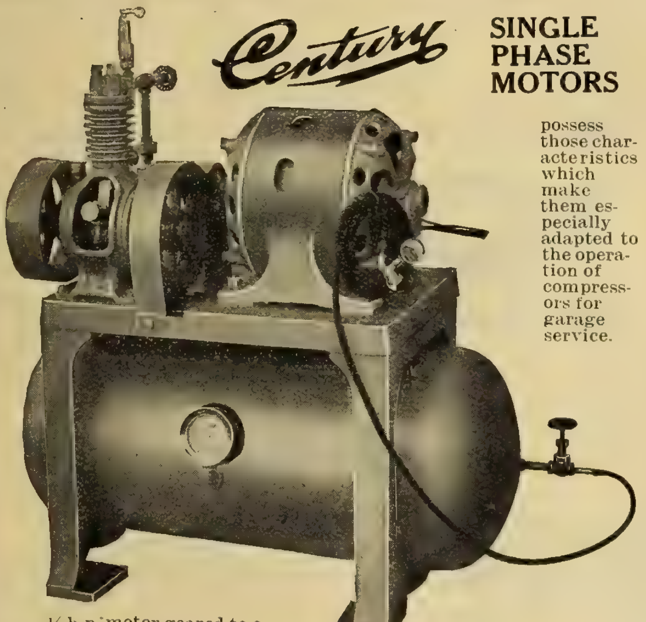

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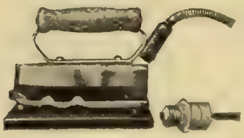

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Unique in that the heater (covering the entire ironing surface) actually **is the bottom** of the iron. Hence more and quicker heat for less current than any other iron of equal capacity. Thoroughout of Simplex Quality—efficiency with comfort to the user. Do you know about **the range** that has revolutionized electric cooking? Send for the new book. **"It Means Freedom."** It will help you.

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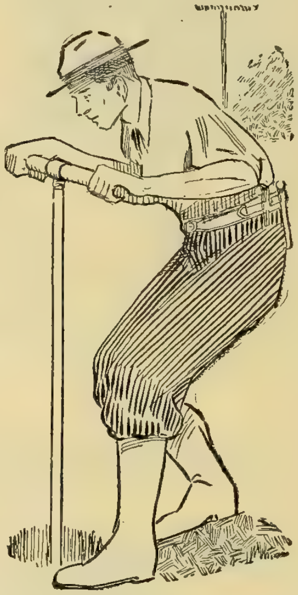

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Produces bright, festive and satisfying effects with little work and at small cost. Colors lamps quickly with a snap and brilliance generally found only in natural colored glass.

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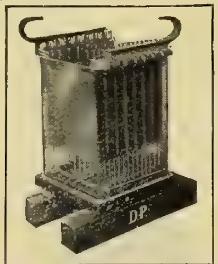

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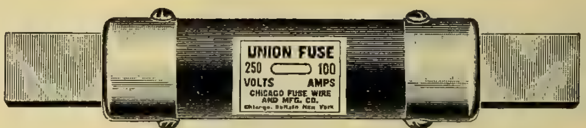

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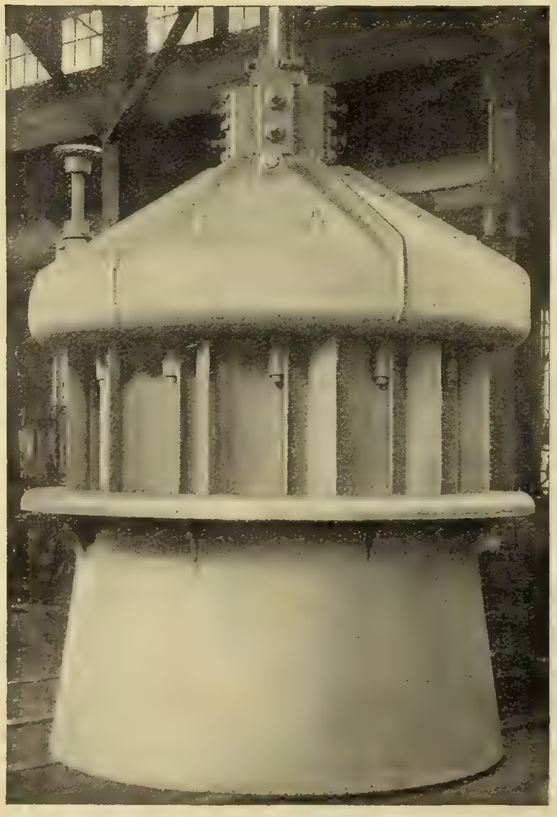

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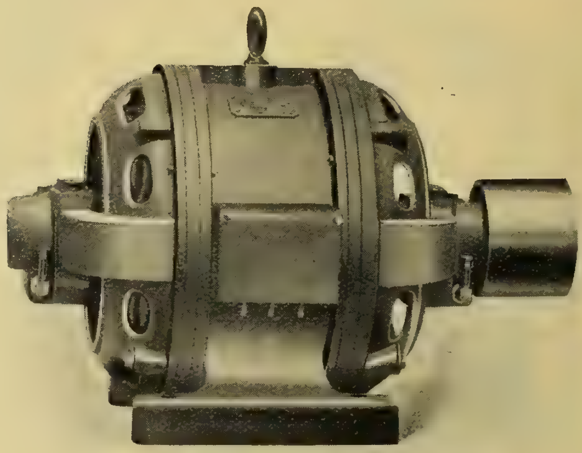

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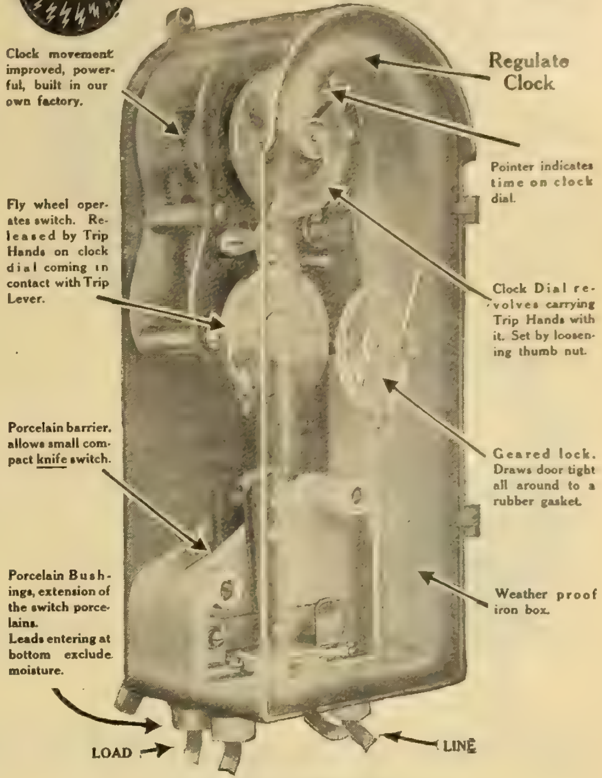
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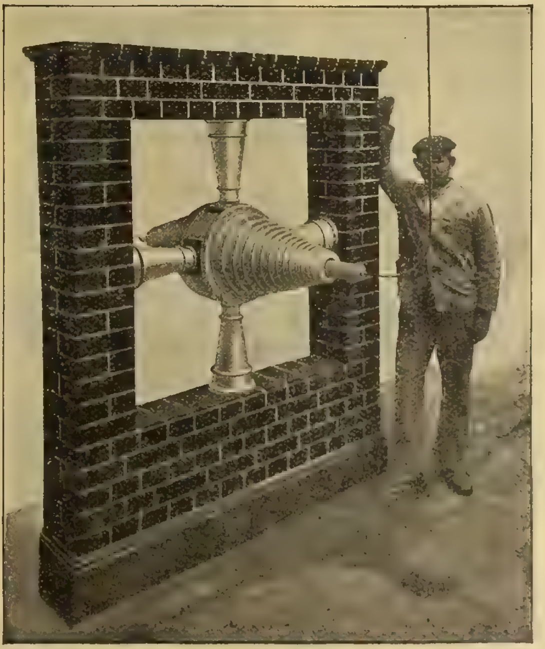

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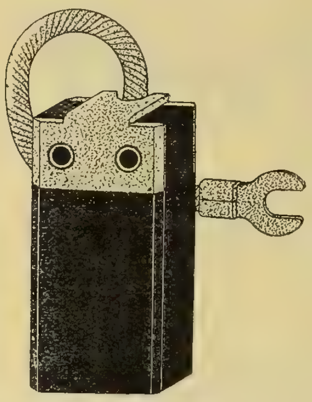

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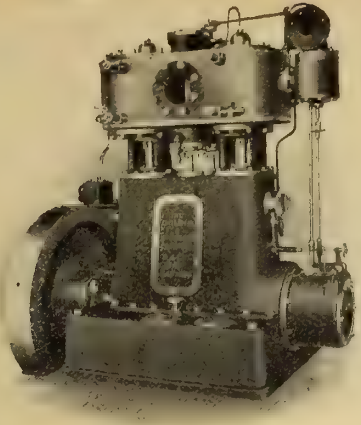

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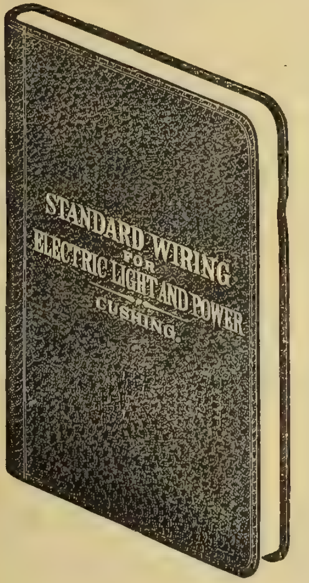

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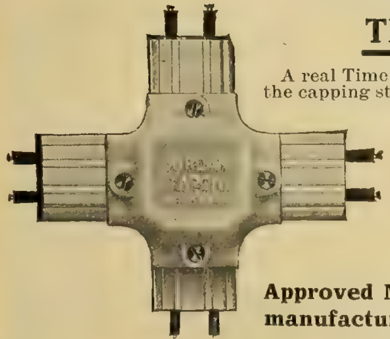

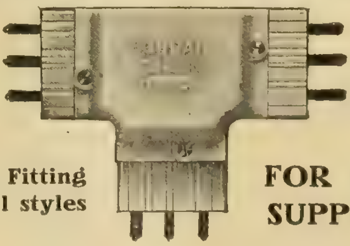

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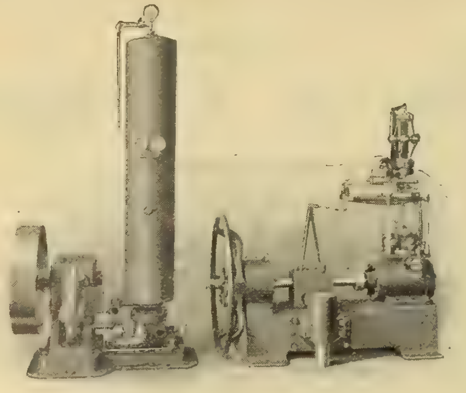

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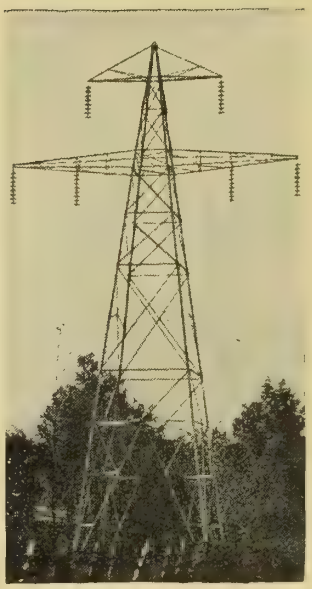

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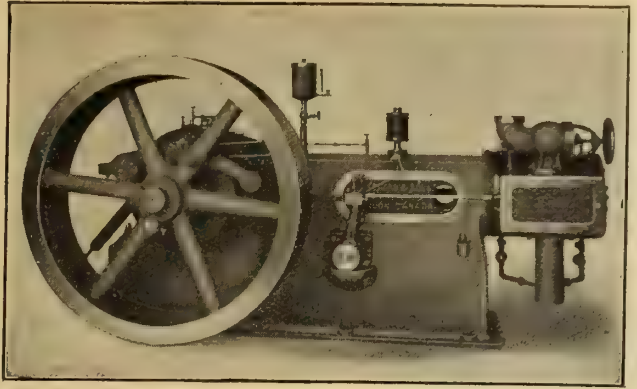

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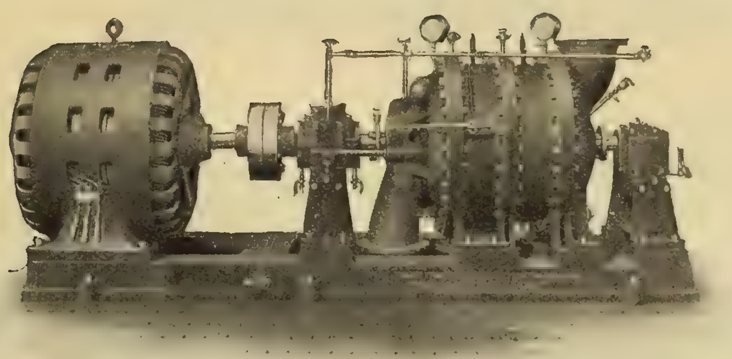

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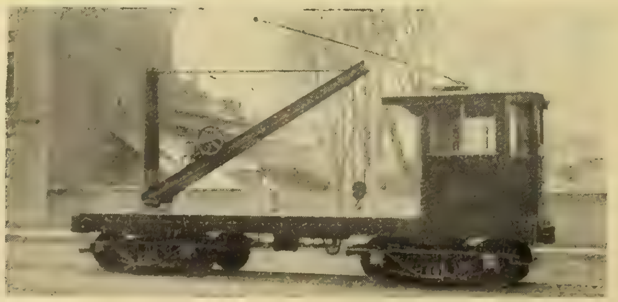

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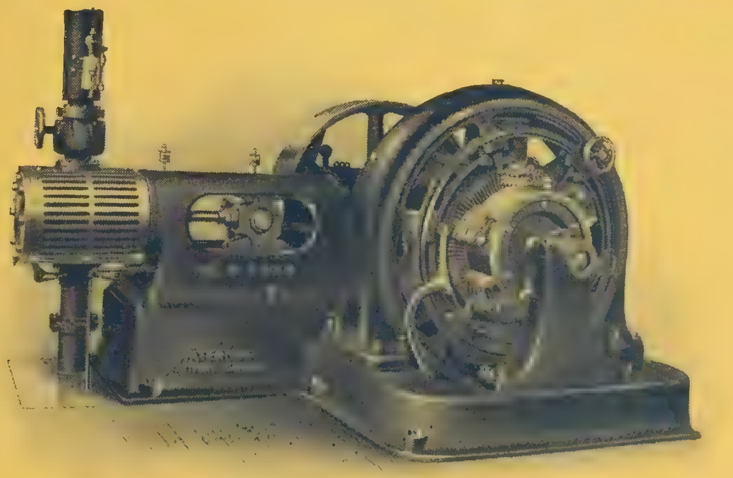

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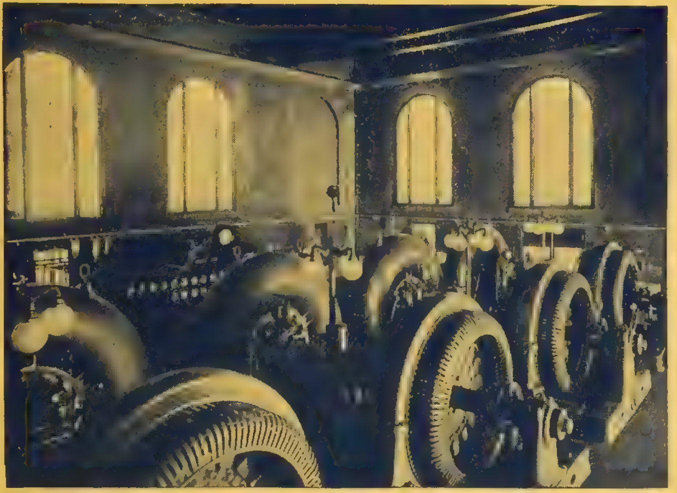

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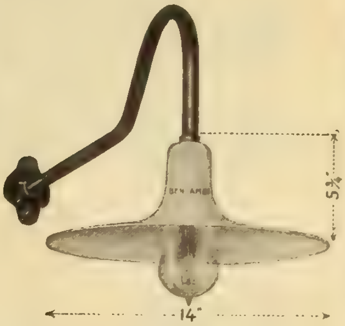

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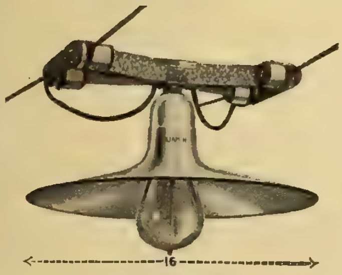

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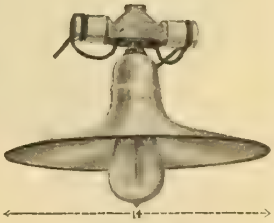

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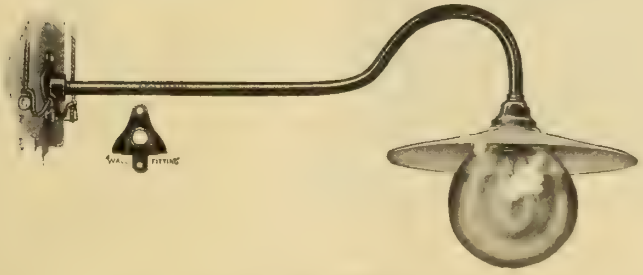

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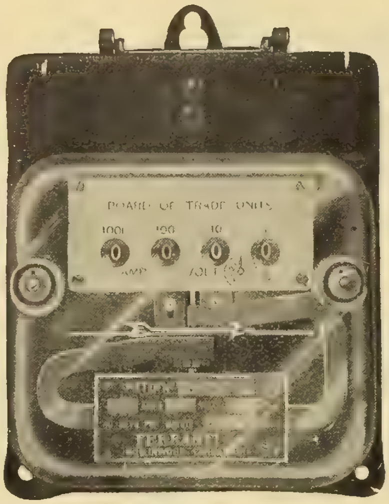


Glass Case—Top Connections

Steel Case—Top or Bottom Connections

Three Phase Pole or Station Transformers

Ferranti Meters

Accurate and Reliable

Ferranti Meters embody that simplicity of construction which assures perfect accuracy and permanent reliability. Their efficiency under light or heavy loads of short or long duration has been proven to the satisfaction of hundreds of constant users.

Cyclometer or clock dials; top or bottom connections.

Every meter carefully inspected and tested before leaving our factory.

Prompt shipments made from our large stocks at Toronto and Winnipeg.

Ferranti Transformers

Efficient and Economical

Of all transformers the three phase type is the most economical to operate and most saving in construction costs.

The efficiency of Ferranti Three Phase Transformers is apparent because of the great reduction in energy-loss. The transmission line thus equipped is invariably a profitable one.

All coils are wound with copper of ample sectional area, thereby reducing copper losses to a minimum.

Write for Further Particulars and let us make an estimate for you.

The Ferranti Electrical Co.

of Canada, Limited

90 Sherbourne St.
TORONTO
and
56 Albert St.
WINNIPEG

Common Sense Dictates Condulets

Because There's a Particular Type Exactly Suited to Each Conduit Outlet Requirement; Because They are Easily and Quickly Installed, Sightly, Strong and Lasting as Conduit—Also, There are Types for Which There are No Substitutes.

Just a Few to Suggest the Line

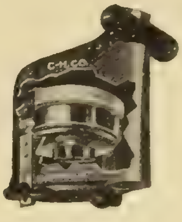
Type V C

Type A

Type E

Type X

Type L B


Type Q H C

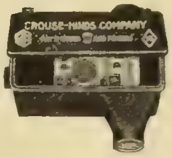
Type F S C

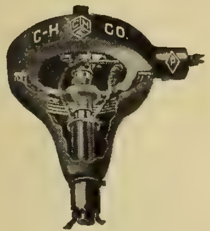
Type K D

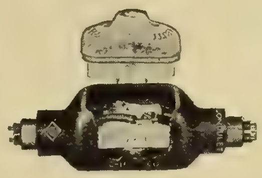
Type H A

Type N

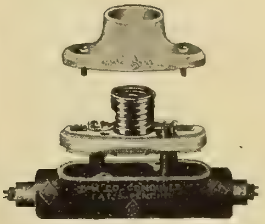
Type S


Type Y S


Type P


Type J

Type F F


Type C

Type G L

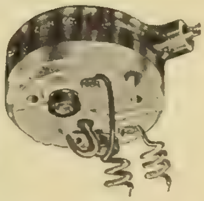
Type W

Type Q K T

Type B

Type F

Type Z D


Type R

Order From Your Dealer. If He Does Not Stock Them, Write Us.

Crouse-Hinds Company of Canada, Ltd.

Main Office and Works:
Toronto, Ontario, Canada

Kindly send me free copy of Condulet Bulletin No. 100·
Name...
City...
Prov... 2013

ADANAC Red Core Rubber Covered

WIRES & CABLES

Adanac Red Core Rubber Covered Wires and Cables

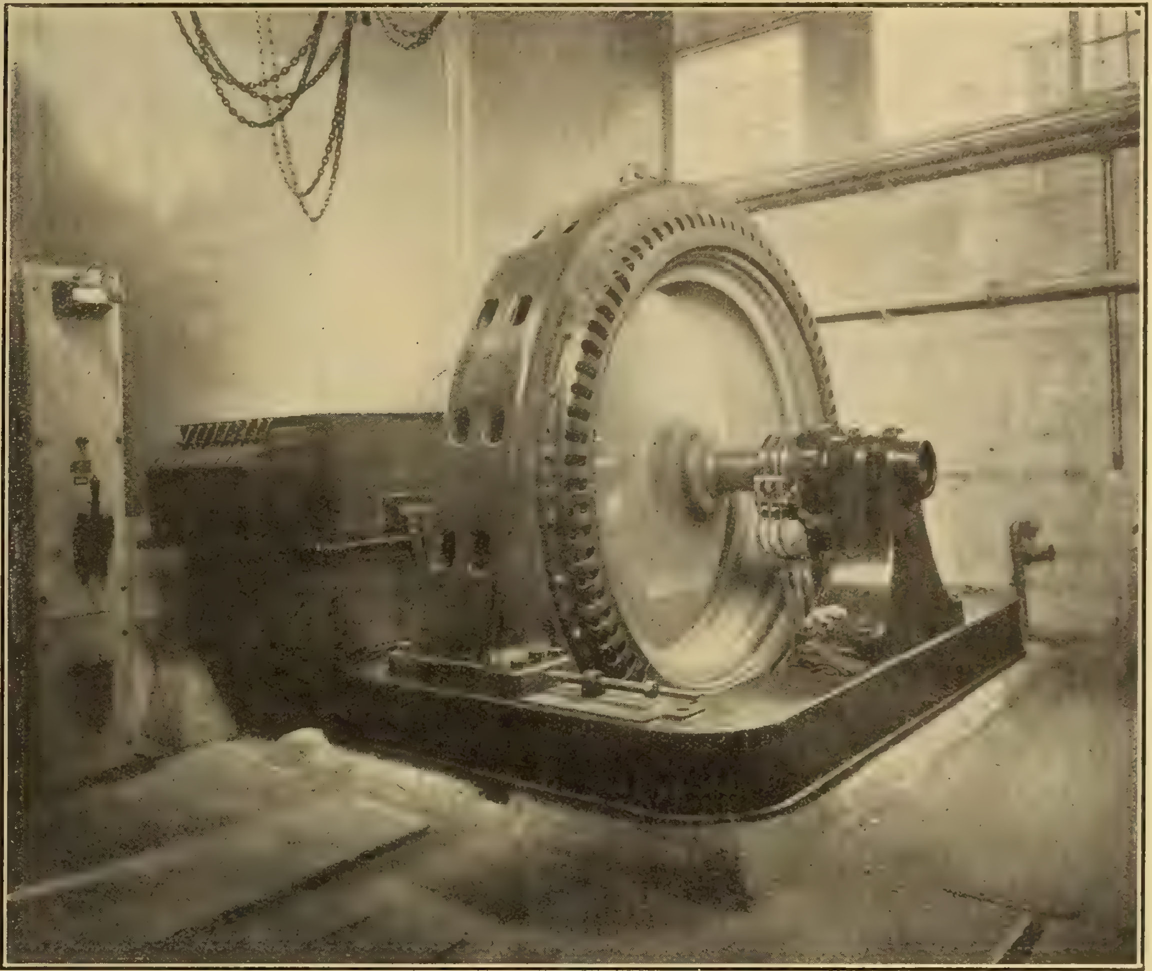
are made according to the specifications of the National Board of Fire Underwriters. The conductors are drawn from copper of the highest conductivity and are covered with two thicknesses of thoroughly vulcanized rubber compound of high quality. The wires are braided over insulation and the smooth high finish they receive makes them specially desirable for conduit work.

IMPERIAL
WIRE & CABLE
COMPANY
Limited
MONTREAL

THE *Northern-Electric*
AND MANUFACTURING CO. LIMITED
SALES AGENTS

TORONTO WINNIPEG
REGINA
CALGARY VANCOUVER

High Grade Electrical Apparatus



1000 H.P. 22000 volt, 3 phase, 60 cycle, 257 R.P.M., induction motor direct connected to pulp grinders at Northumberland Pulp Co., Campbellford, Ont.

Kilmer, Pullen & Burnham,
LIMITED

Head Office,
TORONTO

Branch Offices: MONTREAL
General Supplies Ltd.,
CALGARY, ALTA.

SOLE DEALERS FOR
The General Electric Co., of Sweden

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The Best Endorsement of the value of the "Electrical News" as an advertising medium is the above List of Advertisers

Lougheed Building and Sherman Grand Theatre, Calgary
A "GALVADUCT" Building

"GALVADUCT"

IN every part of North America may be found installations of these two superior conduits. For interior wiring work for every class of building there is no conduit to excell Galvaduct or Loricated.

*"**GALVADUCT**"*—the most perfect interior construction conduit on the market.

*"**LORICATED**"*—A high-class interior construction conduit of the enamelled type.

If your jobber cannot supply you, write us.

Always use "Galvaduct" or "Loricated"

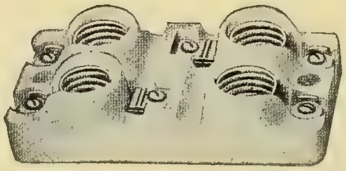
Conduits Company Limited

Toronto - Montreal

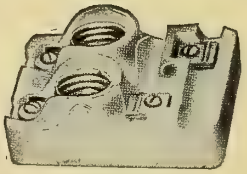
"LORICATED"

DUNCAN

Edison Plug Cutouts and Entrance Switches of Duncan Quality



No. 62587 (¼ Full Size)



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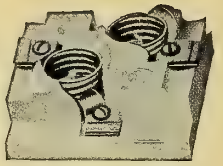

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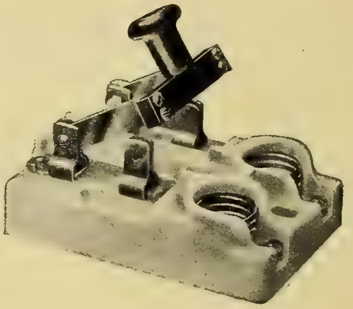


No. 1695 (¼ Full Size)

TRADE DUNCAN MARK

There's your Guarantee

Order through your Jobber

The—

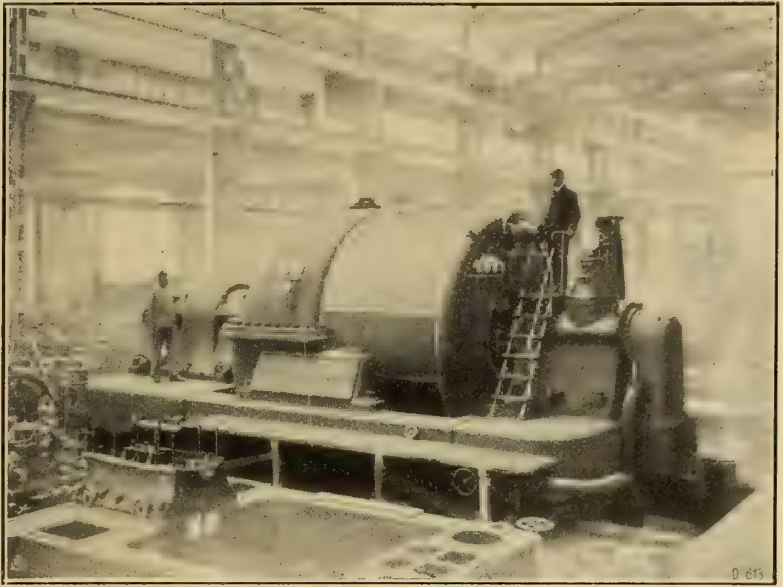
Duncan Electrical Co.

Limited

MONTREAL

Makers of Electrical
Supplies

ESCHER WYSS



28,000 H. P. Zoelly Steam Turbine

'Zoelly Steam Turbines

up to

15,000 K. W.

Water Turbines

Impulse Wheels

Turbo-Pumps

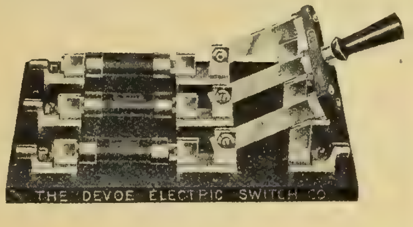
Refrigerating Plants

Escher Wyss & Co., 626 Coristine Bldg., Montreal

The Devoe Electric Switch Company

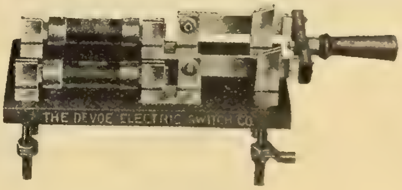
Manufacturers of

Switches, Switchboards, Panelboards, Iron Boxes and Cabinets



Cut No. 343

An examination of "DEVOE" Standard Panels, Switches and Switchboards will convince you they are the best made.



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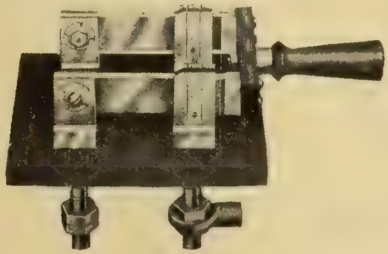
Every "DEVOE" product is built for efficient service under actual operating conditions.



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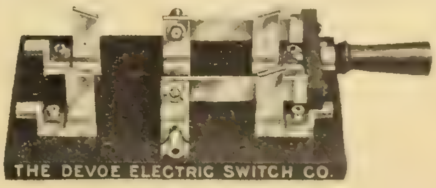
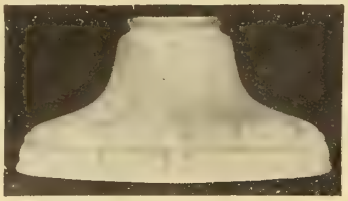


Cut No. 205

OFFICE and FACTORY, 157 Craig St. West, MONTREAL

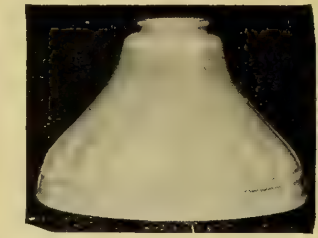


No. 01216

The New

SUDAN GLASS

Panelex Design



No. 01213

SUDAN GLASS is an absolutely new chemical composition.

It is different in every characteristic from every existing opal.

Perfectly uniform in texture, with no specks or other flaws in its surface.

New in design, distinctively alone in quality

All sizes, for from 25 to 500 Watt lamps

THE HOLOPHANE CO., LIMITED

TORONTO - CANADA

CLOTHES DON'T MAKE THE MAN

but good clothes certainly add to appearances

TUNGSTOLIERS DON'T MAKE THE HOME or STORE

but good neat fixtures certainly add to same

—YOU—

SURELY AGREE WITH THE ABOVE STATEMENTS

then—why not sell perfectly made fixtures

YOUR BUSINESS WILL GROW IF YOU DO

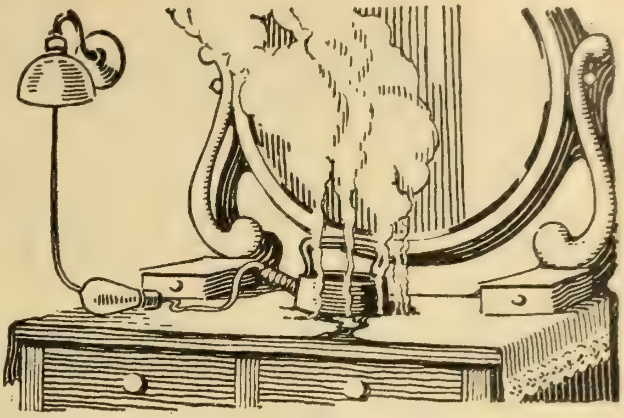
if you want the best trade—get it—sell tungstoliers

The Tungstolier Company of Canada Limited

Manufacturers of Perfectly Made Lighting Fixtures

Head Office—212 King St. West Toronto, Ont.

Many Fires Have Started This Way



A guest at a hotel takes a lamp out of a socket, attaches an electric iron or other heating device, and leaves the room with the current on.

The result is usually a fire, or at the very least a scorching of the dresser, blowing of fuse, etc.

Such fire hazard, not to mention theft of the lamps, etc., can be absolutely prevented by use of the

Shurlok

"The socket that locks"

FOR SALE BY ALL JOBBERS

Carried in Canada by the jobbers listed below who will gladly give you further information and give you the names of Canadian installations. For free booklet use the coupon.

John Starr, Son & Co., Limited	Halifax
St. John Railway Company	St. John, N. B.
Mechanics Supply Company, Limited	Quebec
Dawson & Company, Limited	Montreal
Central Electric & School Supply Company	Toronto
Mainer Electric Company	Winnipeg
Dawson & Company	Winnipeg
General Supplies Limited	Calgary, Alta.
Cope & Son	Vancouver

Pass & Seymour, Inc.

Main Office and Works:

Solvay, New York, U. S. A.

New York City
178 Fulton Street

San Francisco
Rialto Building

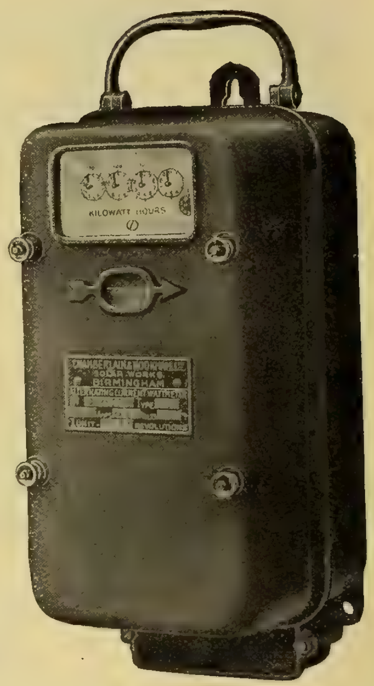
Chicago, 700 West Jackson Blvd.

PASS & SEYMOUR, INC., Solvay, N. Y.
Please send free copy Shurlok booklet and Catalog 29.
Name ....
Address ....
City ....
State ....
Coupon
No. 111

That little *ounce* of prevention

which you might have used, strikes home with a vengeance when you realize that you are daily losing your hard earned profits through inefficient meter service. The faulty mechanicism fails to register a light load or perhaps it fails to record accurately a heavy load of long and constant duration. In either event it means a loss of current—*and dollars to you.*

And again we refer you to that little ounce of prevention.



C. & H. METERS
FOR
Recording Accurately

The slightest detail in design has been so carefully executed that they are at all times efficient and reliable. In registering exceptionally light loads and being particularly accurate for heavy loads of long duration, C. & H. meters are unexcelled.

Let us demonstrate this high-grade meter to you.

We are Meter and Time Switch Specialists

Chamberlain & Hookham Meter Co., Ltd.
120 Richmond St. W. Phone Main 7791
Toronto, Ontario

Spencer & Aspinall, 617 New Birks Bldg., Montreal, P. Q.

The CANADIAN BRITISH ENGINEERING COMPANY
LIMITED

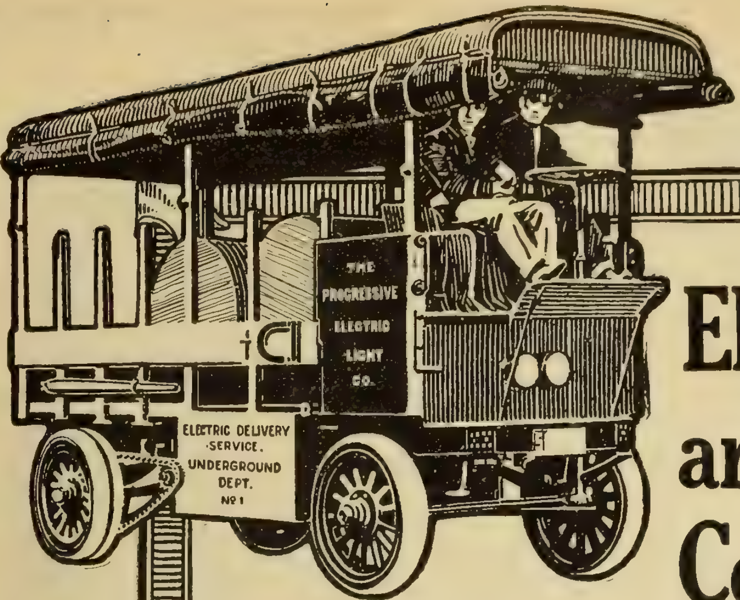
WINNIPEG BRANCH - 324 Smith St., Winnipeg

Wholesale Electrical Supplies

A large and varied stock carried at our Winnipeg warehouse including

- Wires and Cables
- Conduits
- Conduit Fittings and Boxes
- Switches
- Fuses
- Cutouts
- Sockets
- Receptacles, etc.
- Mazda and Carbon Lamps
- Street Light Fittings
- Telephones
- Bells and Fire Alarms
- Dry Cells
- Secondary Batteries
- Heating and Cooking Devices
- Electric Motors
- Electric Meters

OUR ENDEAVOR
is to ship standard supplies the day order is received


THE PROGRESSIVE ELECTRIC LIGHT CO.
ELECTRIC DELIVERY SERVICE. UNDERGROUND DEPT. No 1

Electric Trucks are best for any Central Station

—most efficient and most economical

The Central Station that does not use Electric Trucks is overlooking a big factor for its own betterment. Electric Trucks are most perfectly adapted to the outdoor work of electric lighting companies. They are power plants on wheels—ready always to do their work cheaper, better and quicker than any other type of vehicle. Here are some of the uses to which any Central station can adopt Electric Trucks:

1. **General hauling of all kinds.**
2. **The hauling of heavy material, such as transformers, reels of cable, etc., in which the electric winch is indispensable.**
3. **The application of the electric vehicle in the construction of aerial lines, where electrically operated cranes are used for erecting or removing poles, transformers, etc.**
4. **The use of the electric vehicle in underground work for the drawing in and out of cable and pumping out of manholes.**
5. **The use of electric tower wagon for trimming of arc lamps, etc.**
6. **The adaptability of electric vehicle as an advertising medium.**

Small electric wagons are used by many companies for the delivery of lamps, meters, etc. These wagons are equipped with crates, etc., and have excellent advertising value as well as giving efficient, economical service.

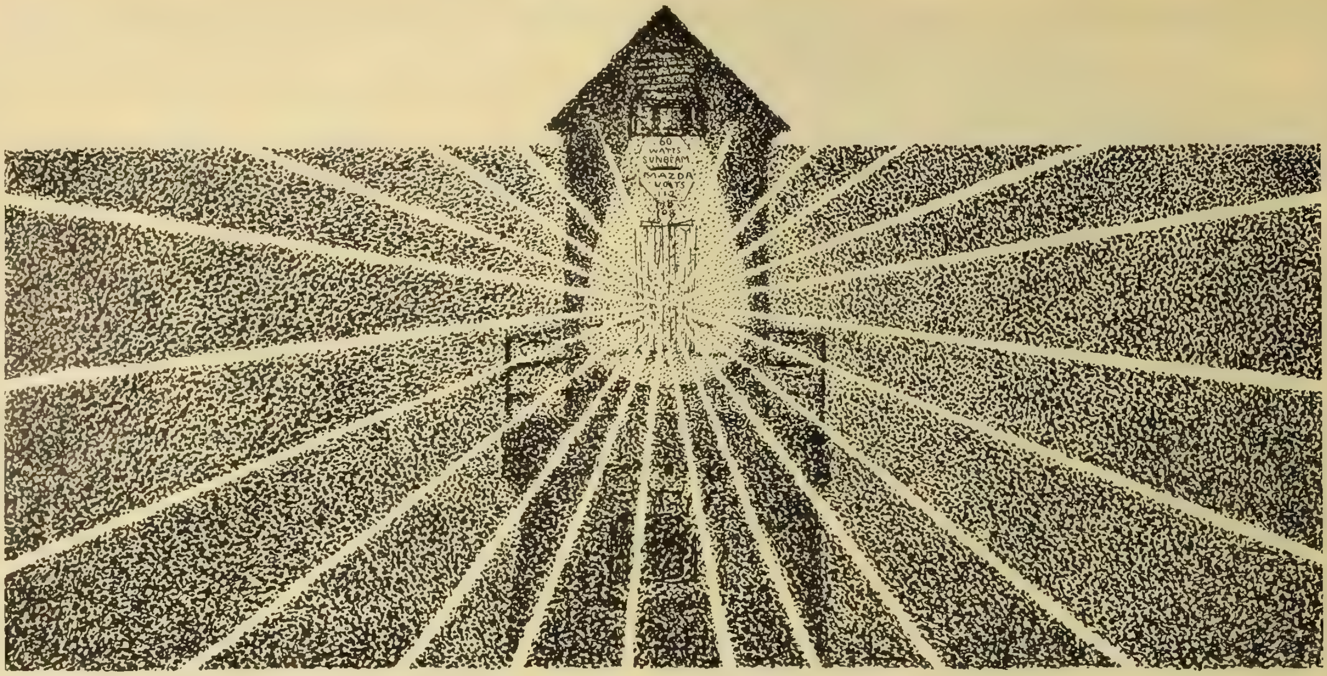
Your use of Electric Trucks recommends them to others

Of course, you know the value of a vehicle charging business in making off-peak hours profitable. Why not boost Electric Vehicles with this end in view?

Once the vehicle users in your locality see that you have confidence in Electric Commercial Vehicles, it will be easy to induce them to follow your lead.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA

BOSTON NEW YORK: 124 W. 42nd St. (31) CHICAGO



A Light to Trust

The light of the Mazda Lamp is superb. It is so distinct, white and steady. When you see a man buy goods year after year from an old established house, you can be practically certain that that house makes good its reputation for high quality goods and superior service.

Assure yourself of your customers' satisfaction by meeting their requirements with

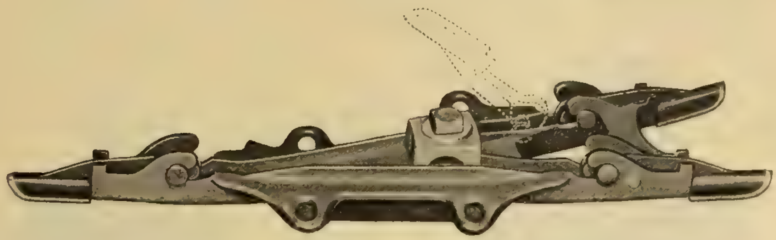
SUNBEAM
Mazda Lamps

Get our prices—particulars and dealers' literature.

Canadian Sunbeam Lamp Co.
Limited

Main Office and Factory: TORONTO

Branch Warehouses: MONTREAL WINNIPEG CALGARY VANCOUVER

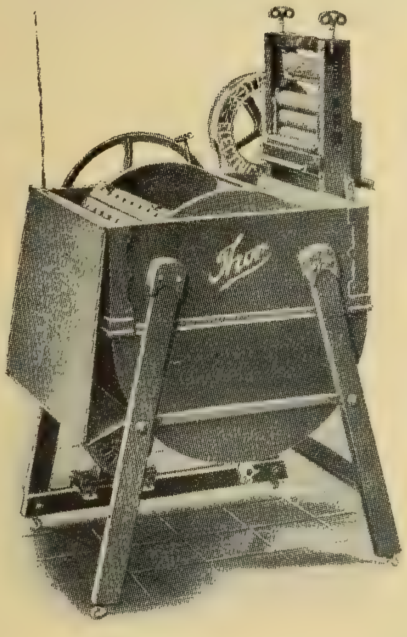


An Overhead Superintendent Said—

"This new Type D Frog is the only real improvement in frogs that I have seen in ten years."

Pages 170 - 172 of catalog No 12 give details

THE OHIO BRASS COMPANY, **Mansfield, Ohio, U.S.A.**



A FEW REASONS

For the Extraordinary Success of the

THOR ELECTRIC WASHER

The THOR is equipped with a guaranteed motor.

Requires no expensive line shaft.

Has an automatic self reversing cylinder.

Has a specially designed reversible wringer.

Requires no special wiring.

Operation is extremely easy—there are no intricate parts to adjust and a turn of a switch controls it instantly.

Write for descriptive literature

The Mainer Electric Co., Ltd.

Winnipeg, Man. - Edmonton, Alta.

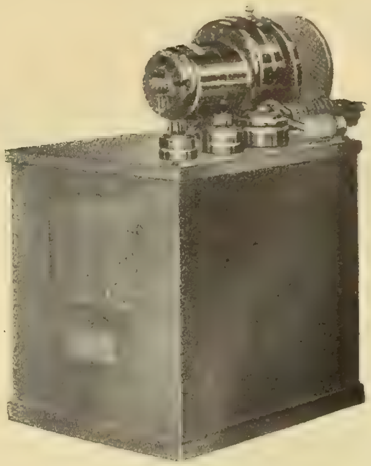
The Largest Electrical Supply House in the West

The Lachute Shuttle Co., Limited

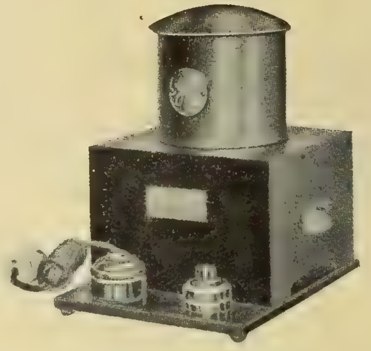
Lachute Mills—P.Q.

Manufacturers of

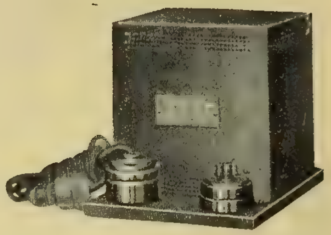
Cross Arms—Space Blocks—Birch and other Hardwood Insulator Pins and Brackets.



Universal Ozonator.



Household Ozonator.



Utility Ozonator.

Ozone and the Ozonator

The usefulness of ozone is now becoming generally recognized. Its most common uses are in destroying disagreeable odors and in making impure air more wholesome.

The C-G-E Ozonator is a highly perfected, practical device for producing ozone by means of electrical discharges.

Ozonators are now used in hotels and restaurants for destroying cooking odors. In theatres and other places where crowds gather, they materially improve the condition of the air. Their use is extending to stores, offices and homes.

C-G-E Ozonators have demonstrated their reliability and usefulness by a year of successful service. Progressive central stations and electrical dealers should be prepared to show the Ozonator to their customers.

C-G-E Ozonators are National Code Standard.

Our Nearest District Office Will Gladly Furnish Further Information and Prices.

Canadian General Electric Co., Limited

TORONTO — CANADA

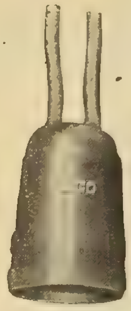
MONTREAL HALIFAX OTTAWA WINNIPEG CALGARY VANCOUVER VICTORIA COBALT
REGINA EDMONTON PORCUPINE SASKATOON NELSON PRINCE RUPERT FORT WILLIAM

C. G. E. Weatherproof Sockets and Receptacles for Decorative Wiring.

Amusement parks, summer gardens, etc., will soon be in full swing. Lay in a stock of C.G.E. Weatherproof Devices now and be prepared to handle the big jobs on a rush basis. **Reliability** characterizes these outdoor devices as it does all other C.G.E. Wiring Devices.

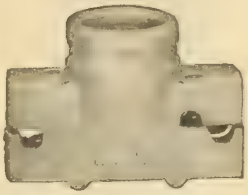
Cat. No. 546

Cat. No. 6878


Cat. No. 545

Porcelain and Hard Rubber Pendent Type

Cat. No. 14091


Cat. No. 14088

Porcelain for Guy Wire Construction

Cat. No. 6861

Cat. No. 6863

Cat. No. 6862

Cat. No. 4123

Moulded Mica and Porcelain Bracket Type

Cat. No. 4128

Cat. No. 7193

Aluminum and Brass Shell for Outlining Buildings

Cat. No. 14047

Cat. No. 6859

Cat. No. 14145

Cat. No. 6826

Porcelain with and without suspension hooks for Guy Wire Construction

Our new Socket and Receptacle Catalogue is now ready for Distribution—Watch for it.
Large Stock of Wiring Devices carried by all our branch warehouses.

Canadian General Electric Co., Limited

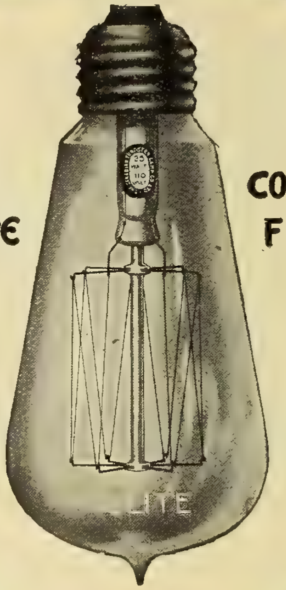
Head Office: TORONTO

Montreal Halifax Ottawa Fort William Winnipeg Calgary Vancouver Victoria
Cobalt Regina Edmonton Porcupine Saskatoon Nelson Prince Rupert

"NULITE"

TUNGSTEN LAMP

GENUINE DRAWN WIRE



CONTINUOUS FILAMENT

"The Lamp With a Record"

Let us prove to you at our expense that Nulite Tungsten Lamps are Superior.

Write for samples

"NULITE"

A Canadian Product Manufactured by

THE CANADIAN TUNGSTEN LAMP CO., LTD.

HAMILTON, ONT.

Branch Warehouses at: **Montreal**—246 Craig St. W. **Winnipeg**—56 Albert St. **Vancouver**—365 Water St.

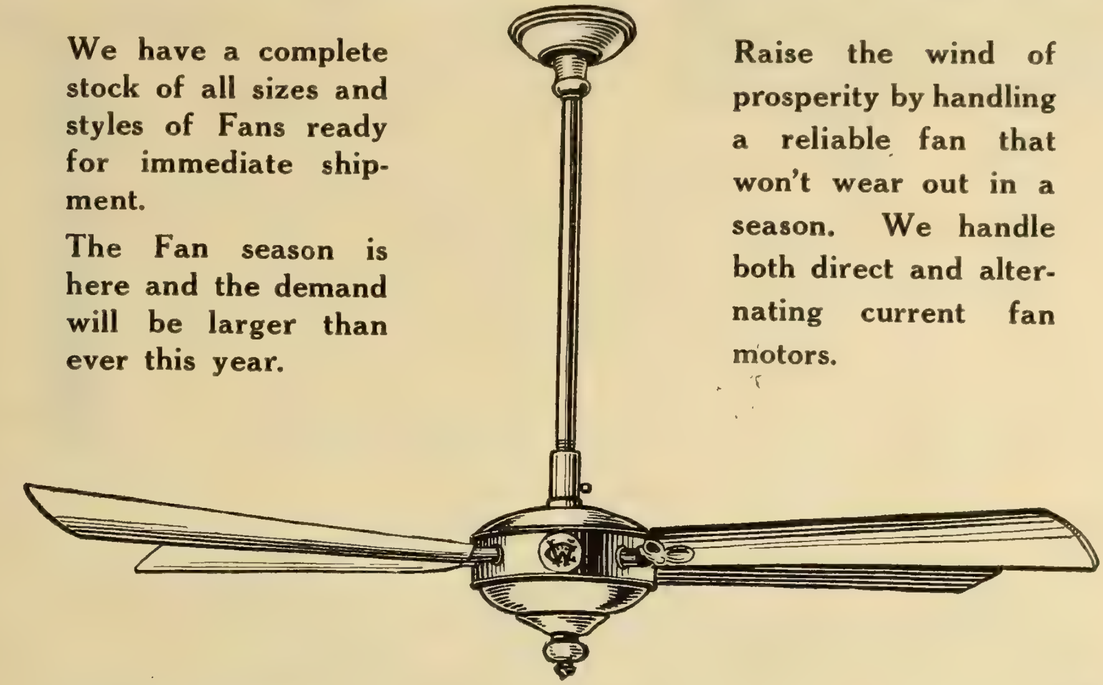
AGENCIES: T. McAvity & Son, St. John, N. B.; Farquhar Bros. Ltd., Halifax, N. S.; Mechanics Supply Co., Ltd., Quebec, Que.; Dominion Illuminating Co., Ltd., Toronto Ont.

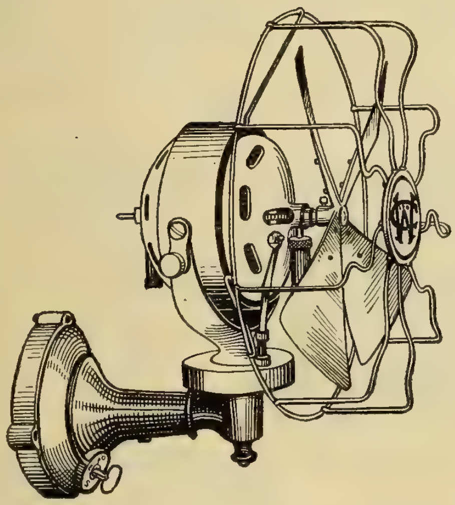
The FANS that LEAD in Fan Time

We have a complete stock of all sizes and styles of Fans ready for immediate shipment.

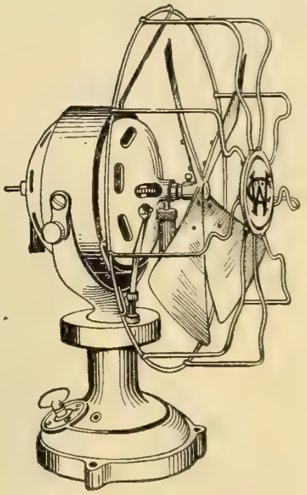
The Fan season is here and the demand will be larger than ever this year.

Raise the wind of prosperity by handling a reliable fan that won't wear out in a season. We handle both direct and alternating current fan motors.





You should have a copy of our Catalogue Write for it NOW



C & W Fans are attractively designed and noiseless in operation.

The C & W line consists of oscillating and stationary desk, wall and ceiling fans, all the neatest and most perfect on the market and far superior to anything heretofore offered.

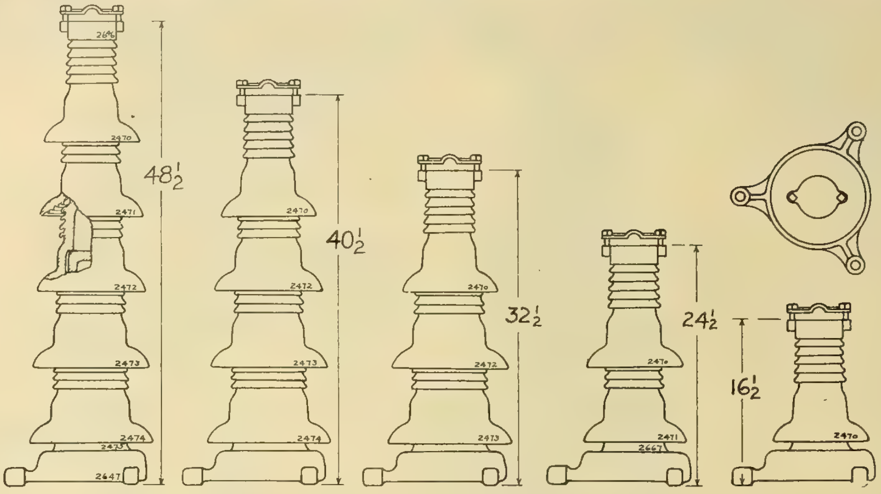
You will be asked for C & W fans this season. Why not lay in an early supply and be prepared?

CHAPMAN & WALKER, Limited

118-120 Richmond St. W., TORONTO, ONT.
VANCOUVER WINNIPEG MONTREAL

THE INSULATOR BOOK

SUBSTANTIAL PEDESTAL INSULATORS



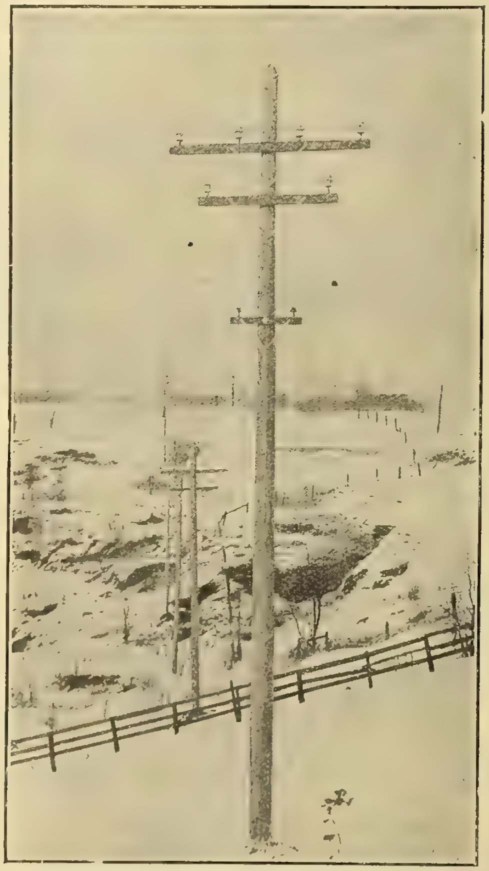
Insulators No. 2648-2669

Porcelain Assembly for No. 2648

Substantiability, electrically and mechanically, is the feature of the design of these insulators. They are intended to be used for supporting bus-bars, switches horn gaps, etc. The clamp piece has three semi-circular grooves 120 degrees apart, any one of which is brought into use by rotating the base of the insulator. The grooves are ½-in., 13/16-in. and 1¼-in. diameter, thus accommodating standard copper pipe as well as flat busses up to 4¼-in. wide and 5/8-in. thick inclusive. Or the two holes (tapped U. S. S. ½-in. - 5⅛-in. on centers) in top cap may be utilized for bolting switches, horns, etc. Torsional strength approximately 20,000 inch-pounds. It will be noted that no metal enters into the design except at terminals.

SEND FOR A NEW ISSUE OF THE INSULATOR BOOK

THE LOCKE INSULATOR MFG. CO. or **Engineering Equipment and Supply Co.**
410 St. James Street, MONTREAL, Que.



A 13.000 volt Transmission Line with Stranded Conductors of British Aluminium

BELOW ZERO

And on Ice-covered Overhead Line. Figure out what this means in the Stress on the Overhead Conductors.

ALUMINIUM

is living up to these conditions every day.

The British Aluminium Co., Ltd.
(of London, Eng.)
60 West Front St., TORONTO, ONT.

You Can Save Money
By Installing
J-M Fibre Conduit
"The Conduit You'll Eventually Buy"

Present day engineering practice requires waterproof ducts in underground systems of distribution.

The Southern California Edison Co., of Los Angeles., Cal., installing 50,000 feet of 3½-inch Style "J" J-M Fibre Conduit on North Los Angeles St., running underground from East Fourth St. to the Plaza 15,000-volt cables to be used.

In addition to being waterproof, J-M Fibre Conduit is light in weight, thereby reducing the cost of freight, handling, hauling and installing.

Has a smooth bore and eliminates abrasions of the cable sheath.

Affords best protection to the cables from stray currents and electrolytic action.

Furnished in socket, drive, sleeve and screw joint, together with fittings and bends to meet all conditions of service. Standard tubes two inches to four inches in diameter; fifty-four inches and sixty inches long.

Quick shipments. Write our nearest branch for full information and prices.

THE CANADIAN H. W. JOHNS-MANVILLE CO., LIMITED
Manufacturers of Asbestos and Magnesia Products ASBESTOS Asbestos Roofings, Packings, Electrical Supplies, Etc. 1679
TORONTO MONTREAL WINNIPEG VANCOUVER

Sundh Tank and Sump Switches.

Rating

30 amperes normal capacity at 115 and 230 Volts A.C. or D.C.

15 amperes normal capacity at 440 Volts A.C.

15 amperes normal capacity at 550 volts A. C. or D. C. but switch should be made double break in which case use 2 pole piece.

The most serviceable switches produced for Controlling Water Levels

Sundh tank and sump switches are rugged in construction and reliable in operation. Have a snap action which unfailingly gives quick break. Absolutely weatherproof.

When double-acting this type of switch forms the most reliable high or low water alarm on the market.

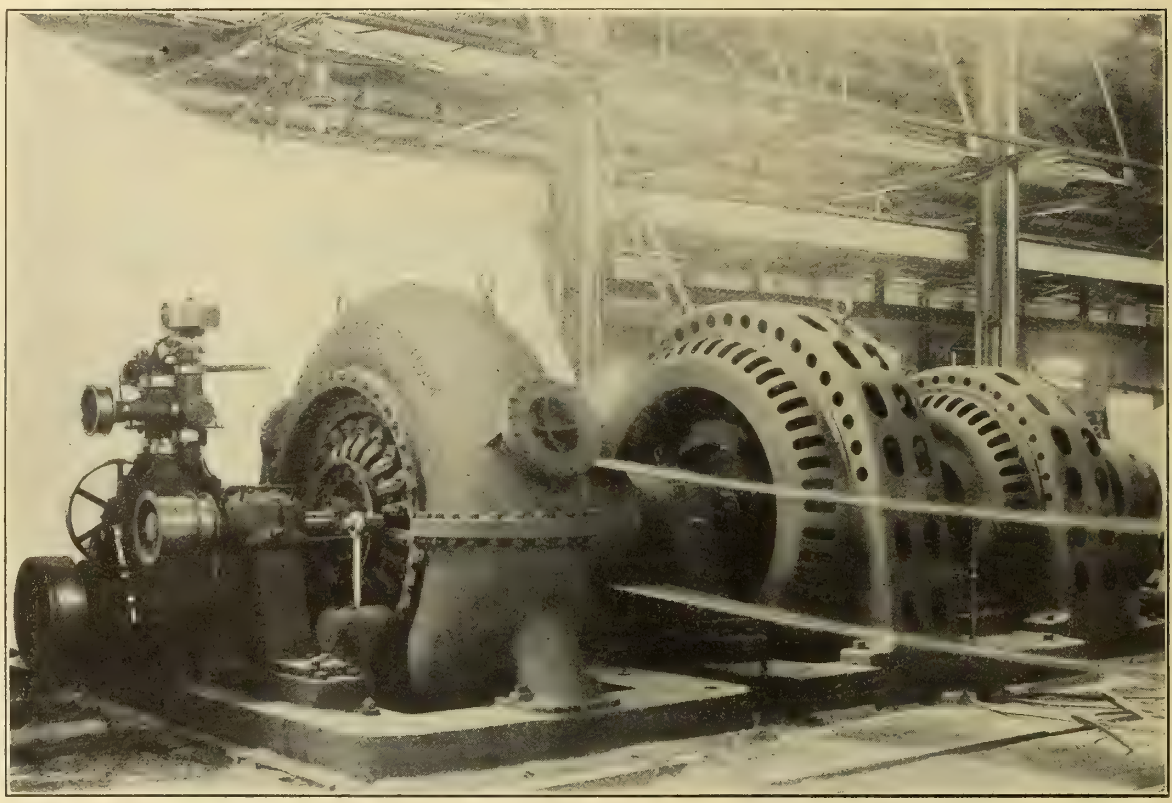
Write for catalog and prices

Sundh Electric Co., New York, U. S. A.
Represented by the C. H. L. Keeler Co., Ltd., Toronto, Canada

Complete

Hydro-Electric Power Plants

Designed and Built



Turbine Motor Generator Set

Under Test in our Shops

When we build a complete hydro-electric power unit, we guarantee a definite electrical output from a given discharge of water.

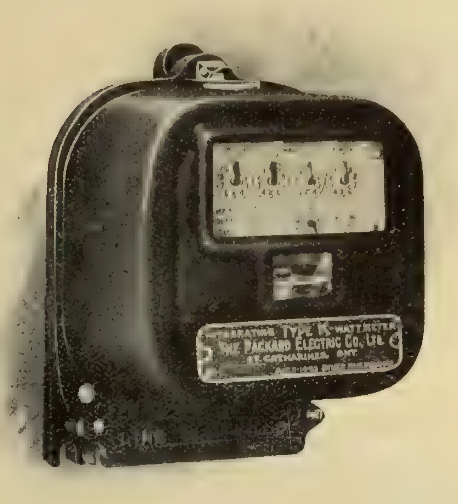
Customers will find it to their advantage to purchase the complete unit from one firm and thus save the trouble and expense which frequently arise when responsibility for successful operations is divided.

WORKS :—MONTREAL and TORONTO

CANADIAN ALLIS-CHALMERS,

LIMITED

Sales Offices: Montreal, Toronto, Cobalt, Winnipeg, Calgary, Vancouver



Metal Case Type K

Polyphase Type PK

Meter Logic

So much depends upon the accuracy and reliability of your meters that you cannot afford to install anything but the **tried** and **tested** variety. Derangement or inaccuracy of the instruments means either a loss of dollars to you or dissatisfaction to your customers. **Both of these conditions must be avoided.**

"PACKARD" Meters

are known throughout Canada and acknowledged by electrical men who know, as the standard for accuracy, reliability and permanence.

The Packard Company was the first company in Canada to manufacture induction meters. The acute importance of the watthour meter was recognized at the beginning, both from the standpoint of the central station and the customer, and every care has been taken to insure "Packard" Meters against the slightest defect.

Large stock carried at

St. Catharines and Winnipeg

St. John Railway Co.,
St. John, N.B.

General Supplies, Limited,
Calgary, Alta.

The Packard Electric Company, Limited

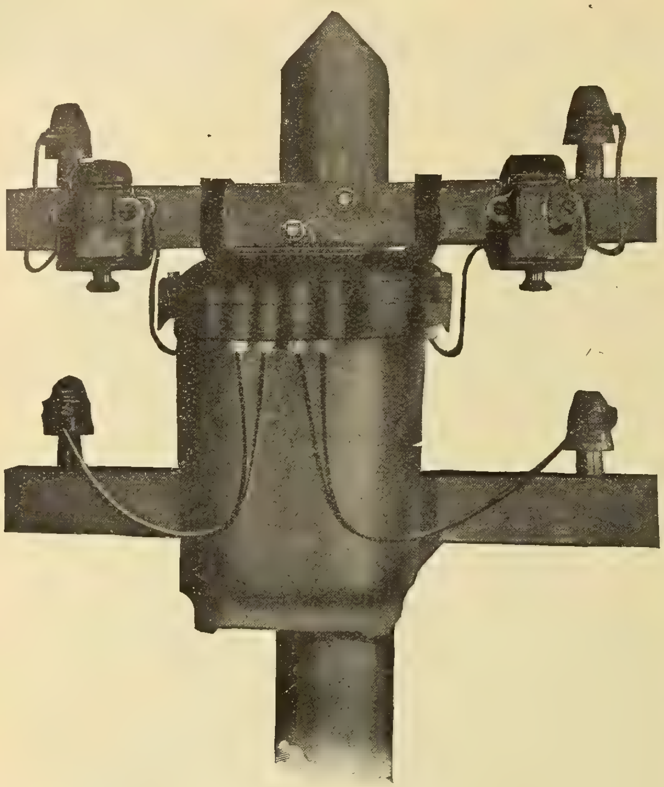
Factory at ST. CATHARINES, ONTARIO

General Sales Office
901-2 Traders Bank, TORONTO

N. W. Office and Warehouse
WINNIPEG, MAN.

On the Line or in the Station

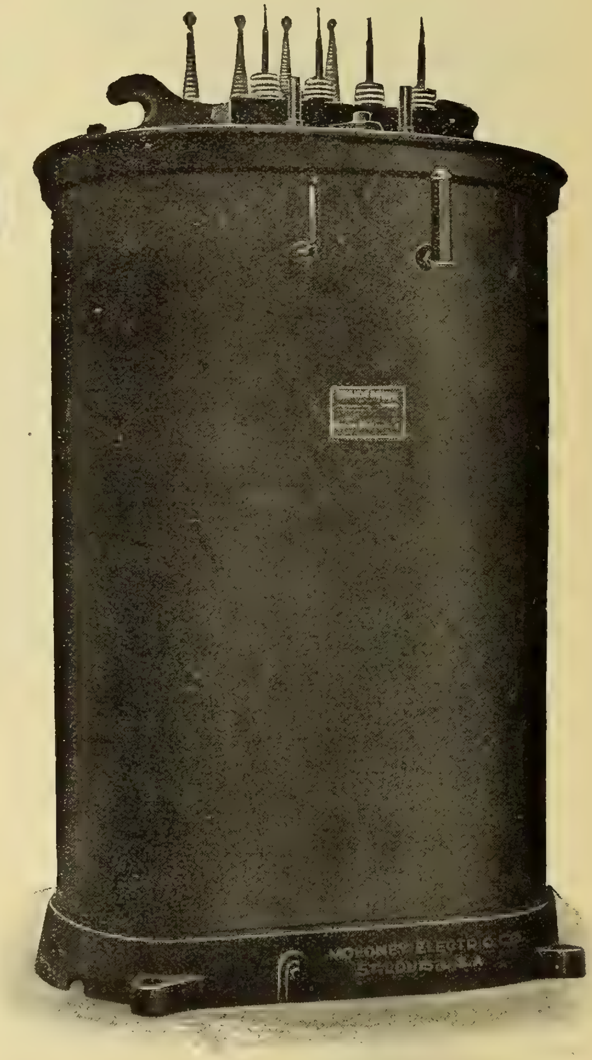
MOLONEY
TRANSFORMERS



They add faithful service to efficient service. You can depend upon them to stay on the job and to pay on the job. Hunt high and low you cannot find higher transformer efficiency nor lower core and copper losses than you will find in a Moloney—the cool transformer.

Our Catalog tells what every Centrifugal Station man and engineer wants to know about transformers.

Send your address if you want a copy.

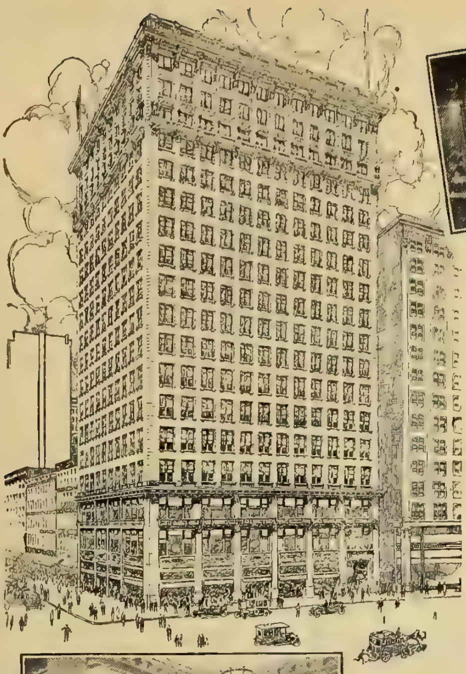


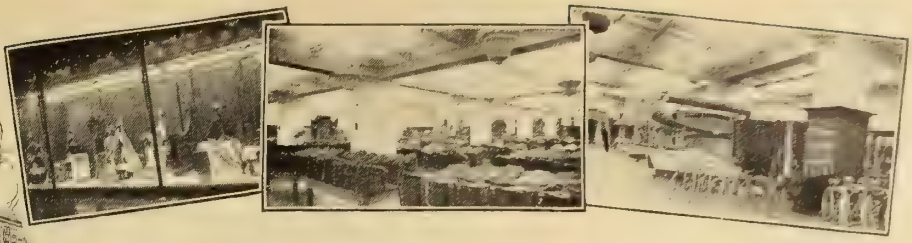
Type E, Water Cooled, 100 to 5000 K.V.A.

Canadian Moloney Electric
Company, Limited

Office and Works: WINDSOR, ONT.

COMPLETE STOCKS
WINDSOR WINNIPEG VANCOUVER





The New Home of "The Hub"

The world's largest men's store is equipped with

The Eye Comfort Lighting System

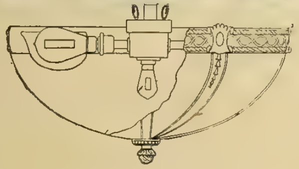
746 fixtures are used in illuminating the six floors and basement of this great store.

Eye Comfort Lighting was adopted after a thorough test of practically every system of illumination. These points were given chief consideration: design, advertising value, first impression, cost, current consumption, cost of maintenance and depreciation.

The real deciding factor was the fact that Eye Comfort Lighting does not distract attention to the light sources themselves, but focuses attention upon the merchandise.

On the first floor the indirect fixtures are varied by the use of illuminated bowls of colored glass (see diagram). A frosted bulb furnishes the light for bowl. It is only 6 per cent. of total light generated. This type of bowl is for ornament only and must never be brighter than the ceiling.

The windows are illuminated by National X-Ray show window reflectors—the only line designed specially for window lighting.



Your Lighting Problems

will be best solved by Eye Comfort Lighting. Send us the blue prints of buildings on which you're figuring for an engineering report. This service will cost you nothing.

National X-Ray Reflector Company

CHICAGO—225 W. Jackson Blvd. **NEW YORK—14 West 33rd St.**

White's Improved Porcelain Strain Insulator

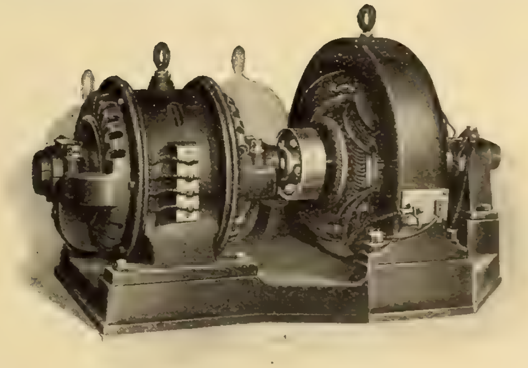
Try this New and Better
STRAIN INSULATOR

Made in Four Sizes. Write for Illustrated Bulletin.

Will furnish Sample if desired.

T. C. White, **1124 Pine St., St. Louis, Mo.**

Special Machines



When in need of any special electrical apparatus or repairs to defective motors or generators, write us. We are fully equipped.

Toronto & Hamilton Electric Company
HAMILTON

Use

Moonstone Glass

for all kinds of

Illumination

The Jefferson Glass Company
Limited

MADE IN CANADA

TORONTO CANADA

Motion Study of a Woman Paying Her Car Fare

The *National Food Magazine* says that if women would pay the same attention to securing efficiency that business men do they could get through their housework with a quarter of the effort—and have more time to play bridge.

In proof that the gentler sex is wasteful of effort the magazine above referred to submits the following motion study of a woman paying her car fare:

1. Opens her satchel and
2. Takes out a purse.
3. Closes the satchel and
4. Opens the purse.
5. Takes out a dime and
6. Closes the purse.
7. Opens the satchel and
8. Puts in the purse.
9. Closes the satchel.
10. Gives the dime to the conductor and
11. Takes back the change.
12. Opens the satchel and
13. Takes out the purse.
14. Closes the satchel and
15. Opens the purse.
16. Puts in the nickel and
17. Closes the purse.
18. Opens the satchel and
19. Puts in the purse,
20. Closes the satchel.

Don't Laugh at the Women

Perhaps you don't always do things in the easiest way yourself. For instance, how much time does it take to send a man the length of your plant to start a motor when the simple operation of a remote control switch conveniently located could be used to save all the steps and time? Are you sure that a motion study of men in your plant would not reveal wastefulness of effort which could be eliminated by the use of automatic motor starters or regulators or by the installation of individual motor drive?

When you are confronted with a problem involving the starting, stopping or speed regulation of an electric motor, how much time do you spend in figuring out a way to accomplish the desired result, forgetting that your problem has probably been solved a thousand times by men who for 20 years have specialized in this line of work.

Cut out the useless motions and put your control problems up to CUTLER-HAMMER.

The C-H Messenger Boy will bring you Bulletins describing controllers suitable for your case

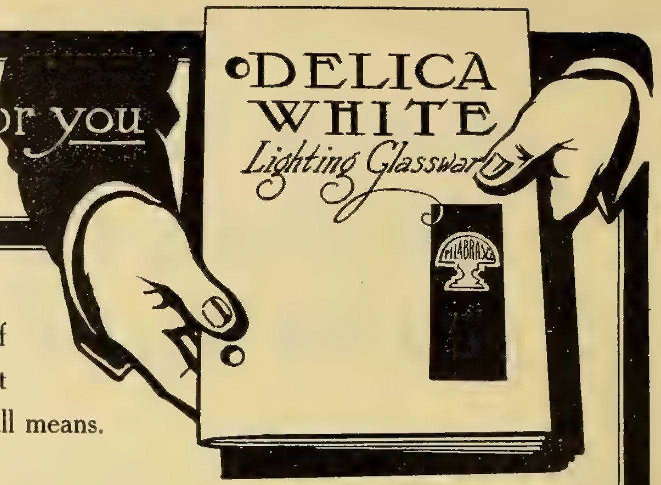
The Cutler-Hammer Mfg. Co., Milwaukee

Largest Manufacturers of Motor Controllers in the World

NEW YORK: Hudson Terminal, 50 Church St.
PITTSBURG: Farmers' Bank Building.
PHILADELPHIA: 1201 Chestnut St.
CHICAGO: Peoples' Gas Building.
BOSTON: Columbian Life Building.
CLEVELAND: Schofield Building.

PACIFIC COAST AGENTS.
H. B. Squires Co., 579 Howard St., San Francisco; 229 Sherlock Bldg., Portland, Ore.
W. B. Palmer, 416 E. Third St., Los Angeles.

We have a copy of this book for you
Write for it



THIS CATALOG illustrates the full line of Delica White, Lily Tint and Ecru Tint Illuminating Glassware. You should have it by all means.

It Will Certainly Help Your Sales

¶ "Delica White" is absolutely in a class by itself. It costs no more than glass of the most ordinary lighting efficiency. And yet you can't get more service or more beauty at any price. From the dealer's standpoint, no more salable or profitable illuminating glassware has been produced in years.

¶ The edition of this catalog was very large but we're being flooded with requests. And you want to be sure of YOUR copy, don't you? Then write for it—today.

The Pittsburgh Lamp, Brass & Glass Co. of Canada Ltd.

PILABRASCO

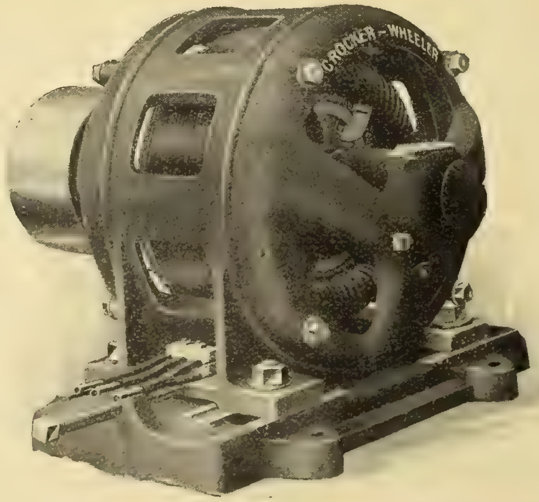
113 Wortley Road, London, Ontario
(R. E. Davis, Special Representative)
General Offices Pittsburgh, Pa., U.S.A.

The design of Crocker-Wheeler Induction Motors

includes

- **Large Shafts**
- **Ideal End Ring Construction**
- **High Power Factor**
- **Large Journals**

They have many other desirable features



Crocker-Wheeler Induction Motor. Sizes from ½ H.P. up

- **Lumen Bearings**
- **Strong Stator Frame**
- **Heavy Insulation**
- **Best Efficiency**

Bulletin 155 describes them

THE CANADIAN CROCKER-WHEELER CO., LIMITED

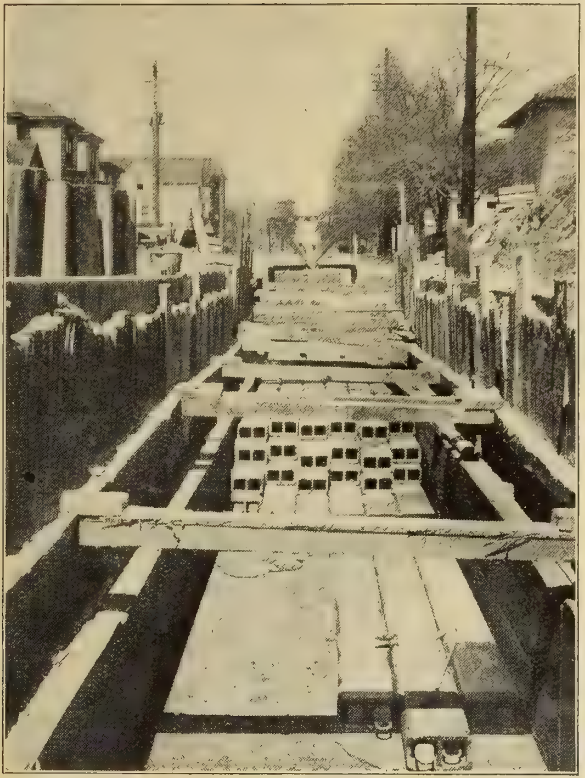
Manufacturers and Electrical Engineers

Head Office and Works:
ST. CATHARINES, ONT.

Branch Offices:
MONTREAL TORONTO VANCOUVER

G. M. GEST

**Conduit Engineer
and Contractor**



Electrical Underground Conduit Systems

When **G. M. GEST** designs and constructs your Conduit System you receive the benefit of many years' experience and specializing in that line of work.

Power Building, Montreal, P.Q.

NEWTYPE

BERGMANN LAMPS

(Tungsten Filament)

The Unbreakable Kind

Are Now Ready for Delivery

We guarantee delivery to you in good condition

EXCLUSIVE CANADIAN DISTRIBUTORS

P. H. KLEIN CO.,
LIMITED

329 CRAIG STREET WEST
MONTREAL, P.Q.

LIVE AGENTS WANTED ALL OVER CANADA

WIRES
and
CABLES

Bare and Insulated in Copper and Aluminum

Railway Feeder Cables
in Copper and Aluminum

Copper Trolley Wire

Copper Clad Wire
(Duplex Metals)

Galvanized Steel Strand
Guy Wire

Canada Wire & Cable Co.
Limited

1170 Dundas Street, TORONTO

Stocks of Wire and Cable carried in Toronto, Montreal, and Winnipeg.

SALES AGENTS:

Roper, Clarke & Co. Limited, MONTREAL
A. E. Esling, Scott Block, WINNIPEG
Macdonald, Marpole Co. Limited, VANCOUVER
Messrs. Gorman, Clancey & Grindley, Ltd. CALGARY and EDMONTON

No 115

BANNER TRADE MARK

Artistic and Attractive Designs in

Lighting Fixtures

"Banner" Electric Fixtures embody al the popular and most up-to-date designs together with many of our exclusive creations.

Write us for an estimate on your next job.

We specialize on making fixtures from original drawings on short notice.

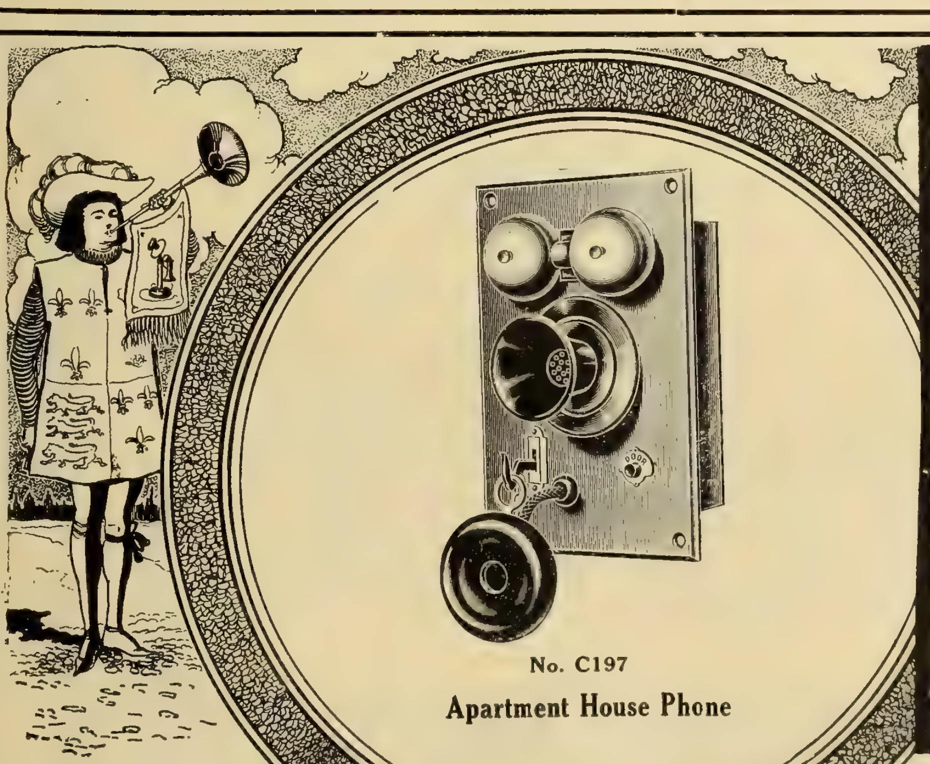
"Banner" Fixtures

MADE BY

No 30014

Ontario Lantern & Lamp Co., Limited,

HAMILTON, CANADA.



No. C197

Apartment House Phone

Agents in Canada with Stock:—

MANITOBA.—The Can.-Brit. Engineering Co., Ltd., 324 Smith Street, Winnipeg.

ONTARIO.—Chapman & Walker, Ltd. 116-118 Richmond St. W., Toronto.

SASKATCHEWAN.—The Northwestern Electric Ltd., Scarth Street, Regina.

BRITISH COLUMBIA.—Cope & Son, Ltd., Water Street, Vancouver.

ALBERTA. — General Supplies, Ltd., 122 Eleventh Ave. W., Calgary.

QUEBEC.—Stocks kept by: Dawson & Co., Ltd., Montreal. Mechanics Supply Co., St. Paul, ..Que.

NOVA SCOTIA.—Stocks kept by: John Starr, Son & Co., Limited, Halifax.

NEW BRUNSWICK.—Stocks kept by: St. John Railway, Dock St.

STERLING TELEPHONES

BRITISH MADE

Your Best Advertisement

is a satisfied customer. Sell a patron something that has the ***works*** as well as the looks and unconsciously he becomes the best possible advertisement you can have. It costs nothing, but it helps wonderfully in building up a reputation.

When you sell

An "American Beauty" Iron

You can be absolutely sure that you are giving your customer real, downright, actual value for the price asked.

This iron is made by the American Electrical Heater Company, the largest and oldest exclusive manufacturers of heating devices in the world. Because of its enormous output, this Company can buy the best possible raw materials at the lowest prices. Their products are designed by Engineers who have given this special line years of careful thought. Only the most experienced and thorough workmen are employed, and the finished article, besides being a thing of beauty, will give the utmost in service.

The Heating Element is Guaranteed for All Time.

SOLE DISTRIBUTORS FOR CANADA

THE Northern-Electric AND MANUFACTURING CO. LIMITED

Manufacturer and Distributor of Telephone and Fire Alarm Apparatus and Electrical Supplies for every possible need.

Montreal Halifax Toronto Winnipeg Regina Calgary Edmonton Vancouver

Your New Construction Will Be Permanent

and will require least maintenance cost, if you make it a fixed practice to use only

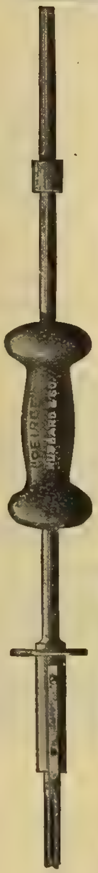
Peirce Brackets

Their heavy, homogeneous coating of pure zinc, put on by the hot-dip process, defers corrosion to the dim and distant future. They are made of channel-section, hot-rolled open-hearth steel, and can be bent double without fracture. All Peirce Brackets are fitted with

Peirce Spring Threads

which allow perfectly for expansion, contraction and inequality of bore, yet always hold the insulators securely.

For attaching Peirce Brackets to brick, stone or concrete walls, the "one best bet" is the



Peirce Hammer Drill and Peirce Expansion Bolts

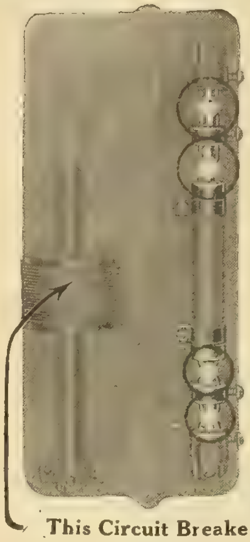
The Peirce Hammer-Drill will drill a hole an inch deep in solid brick in less than a minute. It takes various sizes of drill points, which can be quickly removed for sharpening. Its reverse end is a hollow punch for upsetting the lead sleeves of Peirce Expansion Bolts—it forces the soft lead into every crevice of the brick. When properly installed, Peirce Expansion Bolts will pull off the face of the brick before letting go.

Peirce Specialities and Hubbard Line Hardware are carried by Canadian Electrical Jobbers.

The Hardware MAKES the Line, Hubbard Makes THE Hardware

Hubbard and Company, Pittsburgh, U.S.A.

If These Arcs Hold, Your Line Is Grounded or "Shorted"—



This Circuit Breaker Prevents It

You can't secure the elimination of lightning arrester grounds and short circuits on your lines, unless you use arresters having a **positive means** for cutting off the flow of line current following the lightning discharge to ground.

Most arresters depend on air gaps alone for doing this; but air gaps **alone** won't cut it off positively at all times. It will at times be too heavy, the arcs will hold at the gaps, ground or "short" your lines, blow your fuses, cripple your service.

The **one positive means** that you can use, and the **only** positive means, is the circuit breaker of the Garton-Daniels Arrester; it operates just as surely as if you opened a hand-operated switch in the arrester circuit from line to ground.

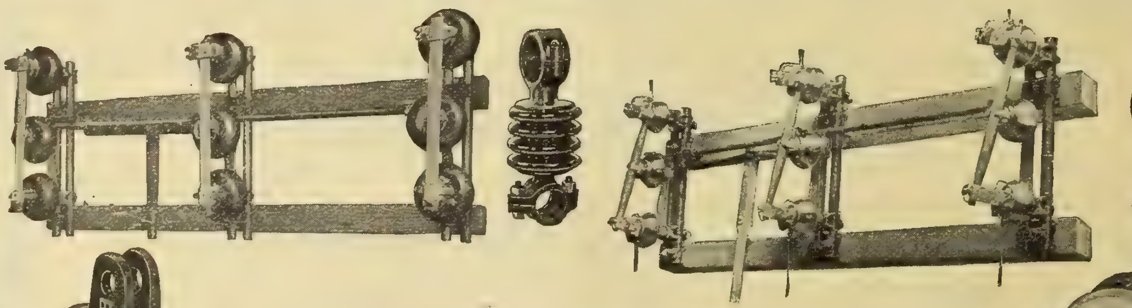
Its cut-off is **positive,** and this positive cut-off means freedom from grounds and short circuits on your lines.

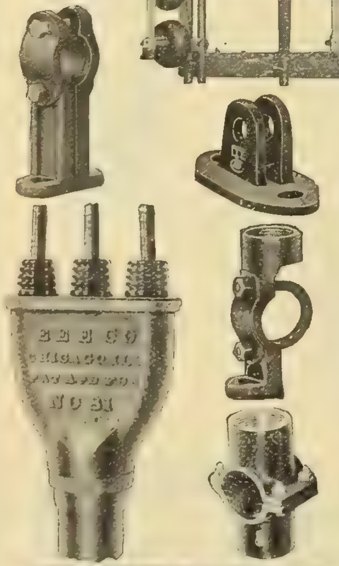
It is because of the circuit breaker **combined** with small air gap distance for efficient protection and low series resistance for eliminating surges, low voltages and similar disturbances, that the Garton-Daniels Lightning Arrester **alone** will give you "Complete" Lightning Protection.

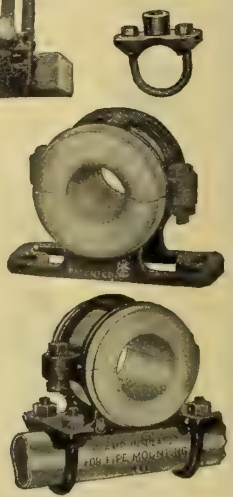
Isn't a "Complete" Arrester the kind you want to use?

JOHN MILLEN & SON, LIMITED
Canadian Distributors
TORONTO
MONTREAL
WINNIPEG
VANCOUVER

ELECTRIC SERVICE SUPPLIES CO.
Manufacturers
PHILADELPHIA, 17th and Cambria Sts.
NEW YORK, Hudson Terminal
CHICAGO, 417 So. Dearborn St.







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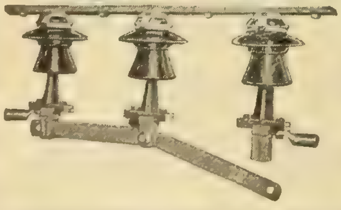

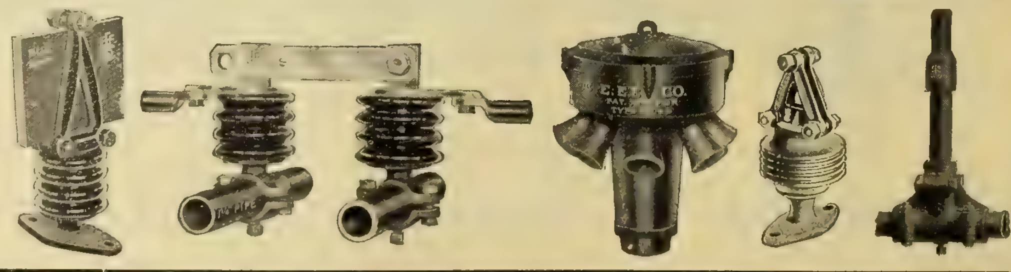

June 1, 1913

Electrical News
Generation, Transmission and Application of Electricity

PUBLISHED SEMI-MONTHLY BY
HUGH C. MacLEAN, LIMITED,
HUGH C. MacLEAN, Winnipeg, President.
THOMAS S. YOUNG, General Manager.

HEAD OFFICE - - 220 King Street West, TORONTO
Telephone Main 2362

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Vol. 22 Toronto, June 1, 1913 No. 11

The Strike Epidemic

The present epidemic of strikes is emphasizing more than ever the apparent inadequacy of our laws in dealing with a matter which is of the most vital importance to the general public. It is unreasonable beyond measure that any mere handful of men should have it in their power to cause even a physical inconvenience to a whole community representing often hundreds of thousands of men, women and children. It is equally unreasonable that they should have the power to tie up as they do the commercial life of a big city or for that matter of a whole province. In most such cases both the personal and financial losses are sustained by persons in no way connected with and only indirectly interested in the questions at issue. Our laws are unquestionably inadequate or their administration poorly carried out if they cannot ensure continuity of service as well during the time in which such matters are at issue between the two parties concerned, as at any other time. The contract between the employer and employee in an electric railway system or an electric light system or on a steam road, should be as binding as any other contract and should include such conditions for the termination of this contract as would make it impossible for either to force the hand of the other by "hold-up" proceedings, such as usually characterize strikes. The whole basis on which the system of strikes appears to be built is that the greater inconvenience they can cause their employers and the general public, the greater is their chance of success. A more selfish, unreasonable, untenable point of view cannot well be conceived. This is quite aside from the merits of the demands made by the men which are often just, but the methods followed in attaining their rights appear to be entirely incompatible with modern civilization.

But the phase of the question that represents absolutely a return to primeval barbarism is that a body of striking workmen should be permitted to use force and if necessary shed blood in preventing anyone else from carrying on the service they themselves refuse to perform. For offences of this kind the laws cannot be too specific nor too strictly enforced. While the recent fatality in one of our cities must be regretted by all, it will be recognized that it resulted directly from a violation of every modern conception of justice and personal rights.

Electrification Costs

A paper printed elsewhere in this issue throws considerable light on the vexed question of the cost of electrification of steam roads and the probability of these roads becoming a paying proposition under electric operation. The article takes its data from a 467 mile road in the western United States, where the conditions of construction and operation are judged to be about normal. It is calculated that the total cost of electrification of a line of this length is slightly under $10,000,000, which works out to between $21,000 and $22,000 per mile. Certain allowance, however, could be made for the steam equipment which brings the total in this case down to slightly under $8,000,000, or approximately $17,000 per mile. It is calculated that the annual saving effected by the change from steam to electric power is slightly under $1,000,000, which works out to approximately 12 per cent. on the original investment. On the supposition that money can be borrowed for half this amount, this looks like a good business proposition. The question, however, hinges very largely on the two balancing items of (1) heavy expenditures involved for initial equipment and (2) increase in net earnings. While the former may be more or less constant, the latter will depend largely on local conditions and can only be determined after a most careful investigation of each individual case.

Calgary's Power Problems

The power situation in Calgary is especially interesting on account of the wide range of choice of prime movers available at that point. There is hydro-electric power obtainable in large quantities; coal of good quality is mined at no great distance; natural gas is obtainable at a reasonable rate which can be used either for firing the boilers or in a combustion engine; and there is any combination of these. The report by Mr. R. A. Ross, which appears on another page in this issue, must of necessity, therefore, cover a wide range of interesting developments for electrical men.

It would generally be considered that Calgary in buying power at $26 is in a particularly fortunate position, but the report is able to offer something still more promising. The figures show that, on the supposition that Calgary in ten years will have a population of 200,000 people and will require 45,000 kws. of energy, this can be manufactured by a coal-fired steam plant for ¾c. per kw. With a gas fired steam plant, however, the cost figures out at .62, and with a gas engine plant at .55. No combination of water power with either of these three was able to show a lower cost. In spite of the lower operating costs of gas plants, however, other equipment, for different reasons, is chosen. It is estimated, however, that further investigations into the possibility of gas driven engines would be justifiable. In the meantime steam turbines with gas fired boilers give promise of the best results.

Special Telephone Articles

We commence in this issue a series of articles on the most approved methods of testing out telephone and telegraph lines in time of trouble or with a view to avoiding trouble, by Mr. T. H. Nicholson. Mr. Nicholson is a man who has been schooled in every stage of the work he rescribes, and we commend his articles to the careful consideration of all our readers who are interested in telephone and telegraph matters. They will be found applicable to equipments of any size and to the apparatus of every manufacturer.

Electricity in New C.P.R. Building

An isolated generating plant—Motors and motor generators for many purposes—Wiring very complete and modern

The electrical equipments of Toronto's tallest and one of her handsomest buildings, the new Canadian Pacific Railway head office building at the corner of King and Yonge streets, possess many features of general interest, as well as a number that are quite unusual and novel.

The building comprises eighteen storeys including a basement and sub-basement. The ground floor and the second floor as well as the fourteenth and fifteenth storeys will be utilized for the C. P. R. business offices while the fourteenth and fifteenth floors will contain almost entirely, the company's telegraph equipment. The intervening storeys will be used for general offices, most of which are already contracted for.

Power and light will be supplied throughout the building by a private plant placed in the sub-basement. There are three generating units, steam engine driven, of capacities 50 kw., 75 kw., and 100 kw., respectively. All these generators are three-wire, 250 volt, direct current, with balancing coils. The generating equipment is divided into three units in this way to make it more flexible, as it will doubtless often happen that even a small unit will be sufficient to carry both the light and power load. The engines were manufactured and installed by the Robb Engineering Company and the generators by the Allis-Chalmers-Bullock.

The argument which probably carried the greatest weight in deciding whether to install an isolated plant in this building was that the steam boilers which, of course, had to be installed for heating purposes, would also operate of necessity during the summer to take care of the elevator load as the elevators are driven by steam operated pumps. The elevators are of hydraulic type, the shaft of one of them which runs to the sub-basement being sunk approximately 250 ft. below the ground level.

The switchboard controlling the power and light was manufactured and installed by the Northern Electric & Manufacturing Company and is shown herewith, both front and rear. There are five panels consisting of three generator panels, one power panel and one lighting plant. The board is supplied, as shown to the extreme left of the figure, with two volt meters and the power panels with six ammeters. These are all of the Weston type. The power and light panels carry three watt meters, Sangamo type. The circuit breakers shown on the three generator panels are I. T. E. manufacture. At the extreme lower right hand corner will be seen a double throw switch which was installed in case it should be deemed advisable to connect up with an outside source of power for emergency purposes or other reason.

A large number of small d.c. motors are used for various purposes throughout the building. For ventilation there are three 6 h.p. motors, one 10 h.p., one 7 h.p. and one 3 h.p. These are C. G. E. motors and are placed three on the roof in the corner towers and three in the basement. Provision has also been made for an air washing machine.

In addition to the ventilator motors there is a 5 h.p. unit installed in the sub-basement to operate the coal conveyor which runs along an elevated track above the front of the boilers. In this connection there is also a one-half h.p. motor which is used to agitate the coal and make it fall freely.

The building will be cleaned throughout by the vacuum process. An American Rotary Valve stationary cleaner has been installed in the basement and will be operated by a 15 h.p. Jenney motor. This motor is controlled only from the basement through a suitable resistance. Two Sump pumps driven respectively by 5 h.p. and two 2 h.p. motors have also been installed in the sub-basement.

A 3 h.p. Sprague motor operates a pneumatic tube system between the floors occupied by the Canadian Pacific Railway Company. This motor does not operate except when messages are being sent, the insertion of the message in the pneumatic tube starting the motor automatically.

The motor installation further includes two small d.c. motor d.c. generator sets reducing the voltage to 20. The 20 volt current is to be used for operating the fire alarm and call bell system which have been installed throughout the building. These motor generator systems will not be required to operate all the time but will be used to keep a 10-cell storage battery of 80 amp. hour capacity charged up for this purpose. In addition to the above motor generators larger sets of various sizes and voltages will be installed for operating the telegraph instruments on the fifteenth floor. A separate board not shown in the figure will be placed on the right of the main switchboard to control the motor generators.

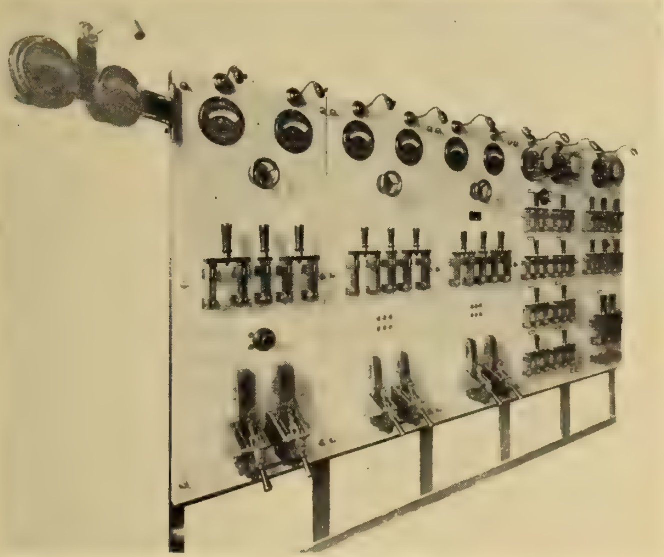
New C.P.R. head office building.

In all there will be 22 panels installed on the different floors, these being placed in a small janitor's room provided on each floor. The panels were supplied by the Mutual Electric Machine Company, Wheeling, West Virginia. These panels will be distributed as follows:—one on each floor for lighting; there will also be one panel for a 300-light sign to be installed on the roof; two panels in the basement and one in the sub-basement. The remaining panels will be for power distribution.

There is also installed on each floor a low tension box in the same room with the panels. These control telegraph and telephone circuits and current for call bells, any of which may be installed in any room in the building. At the same point is also controlled the electric clock system which is being installed by the C. P. R Company for their own use on the floors they will themselves occupy. The low tension box on each floor however, will make electric clocks available at any point if required.

All the light and power wires are run in metal conduit as are also the telegraph, telephone, clock control and call bell wires, as far as the low tension boxes. Conduit up to 3 in. in size was used, this being required for telegraph and telephone purposes. Approximately 50,000 ft. of conduit in all was used in the installation. The conduit was supplied by the Conduits Company, Limited.

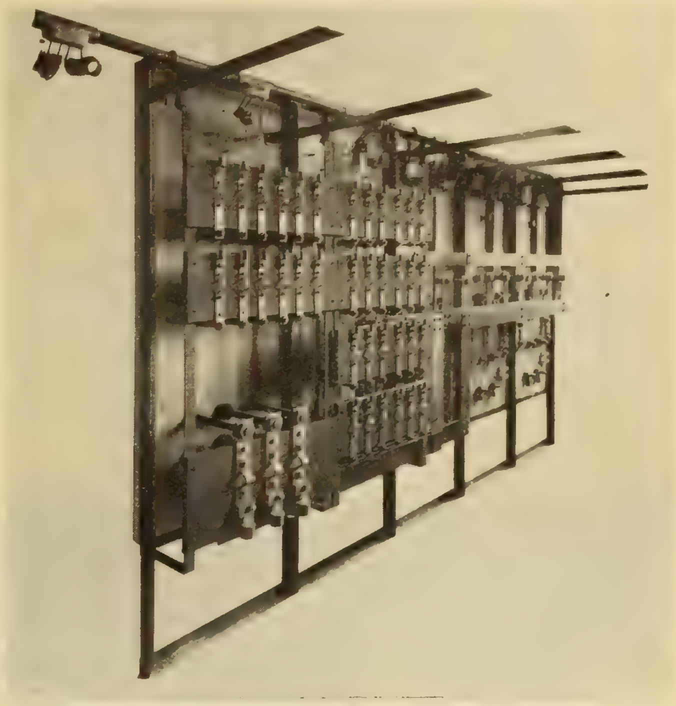
Apart from the lighting on the first and second floors which the C. P. R. Company will occupy, the fixtures represent a rigid simplicity—a single chain hanging from the centre of each room which will carry one lamp only. The size of the lamps will be varied to suit the requirements of the occupants of any particular room. The ceiling lights are however, well supplemented by some 600 base receptacles designed principally for desk lighting. Fans may also be operated from these receptacles. The base receptacles were supplied chiefly by the Bryant Company, but a few are of the H & H type. Some 50 floor receptacles have also been installed, these being supplied by the Thomas & Betts Company.



Main switchboard, C.P.R. head office building.

A very useful feature in connection with the installation of these base receptacles is the method of installing the base board in the various rooms. In an office building of this sort, practically every new tenant wants the outlet in a different place from the last tenant. As a result office rooms are generally very badly cut up by the electrical contractor. By overcoming this difficulty in the C. P. R. building the base board has been made in three members the centre one of which is removable being held in place by a number of wood screws. Having removed this centre board which is about 4 in. in width the wires may be brought to an outlet at any point desired in the room.

The building has been wired throughout by No. 12 wire instead of the usual No. 14. The wire was supplied by the Electric Cable Company of New York. The extra large size will guarantee not only against dangerous heating from overload, but will have the effect of reducing the voltage drop at times of heavy load. The one-light fixtures are being supplied by the Robt. Mitchell Company of Montreal.



Rear of switchboard. C.P.R. head office building

The lighting fixtures in the first and second floors, i.e., in the general offices of the company, will be much more pretentious though with the exception of the mezzanine along one side of the rotunda where indirect lighting units will be installed, only wall brackets will be used.

Flush type push button switches to the number of 350 will be installed. These are manufactured by the Cutter Manufacturing Company. The outlet boxes have been supplied by the Electrical Fittings Company of Toronto, and the necessary condulets, which have only been used for power distribution purposes, are being supplied by the same company.

The electric clock system will consist of eleven clocks controlled by a master clock placed on the telegraph floor. These clocks are self-winding and self-adjusting, these operations being electrically performed. The eleven units will be synchronized every hour. The clocks were supplied by the Self-winding Clock Company of New York.

Thirty-two watchmen's stations and thirty-two fire alarm break glass outlets are installed on the various floors. Each watchman's box contains a magneto which the watchman turns with his key. This makes a record, automatically, on a chart in the engine room, the time and the number of the station being both recorded. This equipment was supplied by the Holtzer-Cabot Company. At each fire alarm outlet a little metal hammer is suspended with which to break the glass cover of the outlet. By striking this hammer against a slightly protruding metal point the electrical contact is made which operates an annunciator and bell in the engine room in the sub-basement. This notifies the engineer to set his force pumps in operation. Two coils of hose are supplied on each floor.

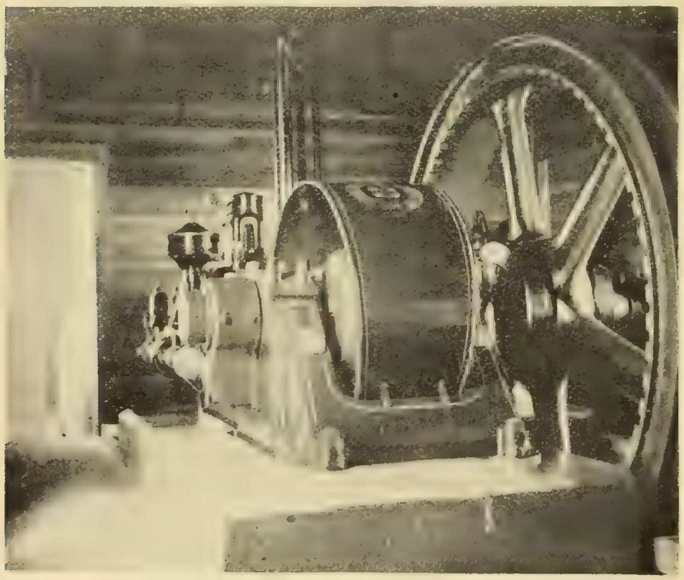
Elevators

The elevators in this building are hydraulicly operated and were installed by the Electric Signal & Supply Company. Lamp signals on each floor, of different colors, announce the approach of the elevators up or down. Lamp signals in the form of moonlights are also operated on the cars themselves by the push buttons from the various floors. That is, as soon as the elevator is signalled from any floor the moonlight is illuminated and remains so until that floor is reached, when it is automatically shut off.

The electrical installation throughout the building is in the hands of the L. H. Nielson Company of Pittsburgh, Pa., though the actual work is under the immediate charge of Mr. W. H. Hall. This same firm are also installing the electrical work in the Fort Garry Hotel, Winnipeg.

New Gas-Electric Plant in Wadena

The municipality of the town of Wadena, Sask., has quite recently completed the installation of a gas-electric light and power plant. The equipment consists of a 60 h.p. Ruston suction gas-engine (manufactured in Lincoln, Eng.), with producer, and a 30 kw. alternating current, 2300 volt, Westinghouse generator with exciter. The gas engine is of the throttle governor type, the governor acting directly on the inlet valve which is double ported, the gas passing through the top port and then mixing with the air as it passes through the second port. Ignition is make and break, current being supplied by two triplex magnetos, each connected to an electrode in the spark plug. Compressed air is used for starting the engine, a storage tank and compressor being provided. Anthracite coal, pea-size, is used in the manufacture of the gas. The producer is built for continuous operation, the ash collecting in a tank of water under the producer from which it may be removed with a scraper.



Interior view Wadena's gas-electric plant.

Before passing to the engine the gas passes through a long tank filled with coke and kept moist by a stream of water, by which means it is cleansed and cooled. No tar extracter is needed with the anthracite coal. The gas passes on from the scrubber to the expansion tank, which is filled with trays of excelsior which collect any moisture or any small amount of tar that may come over from the scrubber.

With the engine operating at full load about ½ to ¾ lbs. of coal is burned per h.p. hour. When running light the engine uses up to as high as 2 lbs. per h.p. hour. There is a very small loss during the shut-down when the coal is banked. The actual running results for the month of March showed 1.8 lbs. per h.p. hour, reckoned in actual energy delivered to the customers.

The engine is water-cooled, thermo-syphon system, 4 tanks 4 ft. x 8 ft. being used. The exhaust valve is cooled from an overhead tank, the water running to waste.

This plant was installed by the British Canadian Engineering and Supply Company, and is now being operated by Mr. T. W. H. Lockhart, who reports that it is working with entire satisfaction. Mr. Lockhart states that the engine could not run steadier and that the speed remains constant at any load.

The figure reproduced herewith shows the engine, with large fly-wheel attached for regulation purposes. The diameter of this wheel is 8 ft. 3 in., face 14 in., weight 10,000 lbs. This heavy wheel, together with a very sensitive governor makes the engine run very steadily.

The cost of the plant, including the setting of 100 poles, the street wiring with necessary transformers, 30-80 candle power tungsten street lamps, and 60-5 amp. meters, totalled $11,000, exclusive of the power house. The power house when complete will cost about $1,200. The power house is 78 ft. long, 14 ft. 6 in. wide and 12 ft. 6 in. high, and includes an office 14 ft. 6 in. x 15 ft., an engine and generator room 14 ft. 6 in. x 44 ft., the producer room 14 ft. 6 in. x 12 ft., and a coal room 14 ft. 6 in. x 9 ft. The outside is finished in clapboards with rubberoid roofing.

The street lighting consists of single bracket lamps with hood. The lamps are 80 candle power, 5.5 amp., arranged in series through a constant current transformer and regulator. The thirty lights at present in use will be extended during the present summer.

Proper Electric Garage Service

By Mr. R. MacRae

The following useful paper was recently presented before the Vehicle Association of America. Mr. MacRae is in charge of the Electric Vehicle Section of the Commonwealth Edison Company of Chicago.

Complaints are often heard about the lack of garaging facilities for electric vehicles; the poor service to be obtained in many of our public garages, and the inexperience of the men in charge of them.

While these complaints are in many cases justified, and while it is necessary to admit that there is almost unlimited room for improvement in the manner in which some of our garages are conducted, we need not be very much surprised to find that such is the case.

When we consider the highly technical character of some of the work that has to be done in an electric garage and how short a time it is since we had garages of any kind, we may rather wonder that the garage service in general is as good as it is.

Although it is an easy matter to find cause for criticism, we must not at the same time forget how much the public garages have done to bring the electric vehicle within the reach of the public, and how much of the interest that is now being taken in these vehicles is due to the work that has been done by the garages.

Without good garage service it is impossible to have good electric vehicle service, and it is now generally recognized that the full development of the electric vehicle industry can be brought about only through the agency of properly equipped public garages.

It is of the highest importance, therefore, that the question of garages receives the attention of everyone who is interested in the success of the electric vehicle and especially the attention of the Electric Vehicle Association.

As far as methods of operation and equipment are concerned, the electric garage differs quite as much from the gasoline garage as each of them differ from the livery stable; the methods that answer all right for one will not apply at all to the others.

If it were asked what is the best possible garaging system for electric vehicles that we could have in a city like Chicago it might not be an easy matter to get the right answer; there would, no doubt, be considerable difference of opinion on the subject. It would be readily admitted, however, that such a system would be quite different from anything that we now have. It is not necessary to speculate much on this question as we are now more concerned in seeing some improvements in the garaging arrangements that we have than in discussing ideal garages.

It must not be inferred from this that we have no good garages. There are several of them, but there are so many that do not belong to this class that the urgent need for improvements cannot be disputed.

The remedies needed to bring about such improvements may be indicated by drawing attention to some of the facts of the garage situation.

The manner in which a new electric garage makes its appearance is quite often somewhat as follows:

A large building more or less suitable for the purpose is rented by someone who has decided to start an electric garage. The fact that he does not know anything about an electric vehicle does not worry him any. He is satisfied that he knows as much on the subject as some others did when they started in the business. After he has fixed up one or two charging plugs and rheostats he puts a sign in front announcing that the place is an electric garage, where storing, charging, repairing and expert battery service may be obtained. When the first customer comes in, the Central Station is asked to send a man to test the polarity of the charging wires and to show how the charging current can be regulated. Next day the proprietor of the garage, being in some doubts as to whether the vehicle was charged or not, anxiously awaits a call asking him to come to tow the vehicle in. If no such request is made and the vehicle gets back to the garage under its own power, he is satisfied that there is nothing more for him to learn about the management of an electric garage. Everything goes smoothly for a day or two and a new name is added to the list of electric vehicle experts.

Attendants Lack Knowledge

Not long since one of these ready-made experts, in claiming that his power bills were too high, argued that it was impossible for any electricity to go into a battery after it was fully charged and that it made no difference whether the charging switches were closed or open.

Another expert, who had as many as 30 cars to attend to shortly after he had opened his garage, and who was obliged to acquire his electrical knowledge rather hurriedly, was heard to remark: "You can't tell me that a slow charge is the proper thing for a lead battery; by forcing the juice in strong I can get the voltage of my batteries up in half the time that some of these other fellows take, and I can get along with half as many charging plugs."

This man sold the business out to another who had no previous experience with electric vehicles. The new man not only did not know anything about electricity, but did not think it necessary to learn anything. The garage did not prosper under his management and in a short time he lost about half of his customers. As he kept no records whatever of the amount of electricity that he was using, he was rather surprised when the monthly power bills came in to find that they were larger than the bills paid by his predecessor, who had twice as many cars to charge. Investigation showed that the boy who did the charging found it more convenient to let the current run into the batteries all night than to watch to see when each car was charged and that he sometimes used as much as 25 kilowatt hours to charge batteries that had a capacity of only half that much.

On account of such conditions as these it has been seriously maintained that it would be better for the electric vehicle industry if there were no public garages, and that better results would be obtained if each owner kept his vehicle in a private garage. Experience, however, has shown that such is not the case. If the treatment that vehicles get in public garages is sometimes bad, what happens to them in private garages is often worse.

Old stables, woodsheds, and such structures where one or two electric vehicles are sometimes found and where there are no facilities for doing anything, and no one to look after the vehicles who can tell a battery jar from an oil can, are not suitable places in which to keep electric vehicles.

When we hear that electric vehicles operated under such unfavorable conditions are a failure, we need not be surprised or discouraged—we have no right to expect anything else.

Electric Vehicle Rarely to Blame

It is seldom a failure of the electric vehicle; it is a failure of the method of operating, or rather the failure is due to a lack of any rational method of operating. Probably 75 per cent. of the so-called electric vehicle failures have been failures of this kind.

These make-shift garages, however, have shown that satisfactory service can be obtained from electric vehicles under conditions that would be prohibitive for any other type of vehicle now in use, and they have been the means of demonstrating beyond any question that an adequate garaging system is the only thing now needed to enable the electric vehicles to drive the horse-drawn vehicles entirely from our streets.

The disorderly ideas that prevail in regard to the care and operation of electric vehicles are not due to any lack of intelligence on the part of owners of vehicles and garages; they are wholly due to the fact that there are no authoritative instructions to be had on the subject. Vehicle owners are naturally anxious to give the vehicles the care that will enable them to get the best service from them, but the vehicle manufacturers have so far published scarcely anything to indicate how they would like to see the vehicles cared for. Having no definite instructions to follow, each vehicle owner is obliged to do the best he can, and the result is an amazing variety of opinions in regard to the best methods of charging and operating.

A few days ago the manager of a small garage complained that his charging apparatus was not working properly. He had four electric trucks—two of them having lead batteries, and two of them Edison batteries. When asked if he had any printed instructions or cards telling how the charging should be done, he said: "We never had a scrap of charging instructions in this barn." Another who was having troubles of the same kind was asked: "Why don't you get charging instructions from the agent who sold you the car " and the reply was: "Those boys down there don't know anything, and even if they did, they would not tell you anything." Almost any number of such instances might be given.

The remedy for this situation, which is doing so much to retard the introduction of the electric vehicle, is not hard to find; it is simply an admission on the part of vehicle manufacturers that operating instructions are needed.

For years the main talking point of the electric vehicle salesman has been that it is not necessary to have an experienced man to operate an electric vehicle. Not long since I asked an agent if it did not take considerable time to learn how to take care of an electric vehicle, and was told that anyone could learn all about it in less than half an hour. "But the battery requires quite a lot of attention, does it not " "Why, you don't have to bother about the battery; we furnish an automatic charging apparatus, and all you have to do is to start it and the current will shut itself off when the battery is fully charged."

A visitor to our automobile show from the East told us here a few weeks ago that when questions in regard to batteries or power consumption were asked of the vehicle salesmen at the Coliseum, the answers given were outrageous, and then for fear of hitting our local pride too hard, he quickly added that conditions were no better in that respect where he came from. Some such answers, however, are the only ones that can be given as long as vehicle manufacturers think that the term "kilowatts" is too academic for everyday use.

When the question of operating instructions was taken up not long since at a meeting of the Electric Vehicle Association one of the speakers said that the best thing for an electric vehicle operator to do was to leave the vehicle intelligently alone and rely on some vehicle expert to keep it in working condition. He also said it was not customary for vehicle manufacturers to issue printed instructions for operating, but that they supplied the instructions published by the battery manufacturers. These opinions and this method of disposing of the question of instructions seemed to have the approval of the meeting, as no criticisms were offered.

Value of Full Instructions

It is evident, however, that this is a very unsatisfactory way of dealing with the situation. Nothing can be gained by giving the impression that an electric vehicle is such a mysterious piece of apparatus that it takes a man of more than average intelligence to get a working knowledge of how it is constructed, and to ask the battery manufacturers to supply all operating instructions and in this way assume the responsibility for the operation of any and every kind of vehicle under all sorts of conditions is clearly unreasonable.

The first thing that the purchaser of an electric vehicle has to think about is electric power, and it is for the purpose of getting power that he applies to the electric garage. It is obvious, therefore, that the garage man should under stand thoroughly how to measure electric power and how to use it economically, and that the man who gets the power should know what to ask for.

On the subject of power, scarcely anything is said in the literature now given out by the vehicle manufacturers and a lot of talk about foolproof apparatus has created the impression that it is not necessary to know anything about it.

While the attention necessary to keep an electric vehicle in good working order is very small compared to that which is required for vehicles using other power, the electric vehicle is still a long way from being foolproof and is likely to remain so, no matter how much it is improved or how many automatic devices are attached to it. When this fact is fully recognized by the vehicle manufacturers and is made clear to the purchaser of a vehicle at the time a sale is made, it is quite certain that we will hear less about neglected batteries and unusually large power bills, and that the service in our garages will be brought much nearer to what might be called an ideal standard.

If your copy of the Electrical News is not reaching you regularly, advise us.

Lignite Coal for Power Purposes

Possible advantages of central power plants at Lignite Fields —Overcoming loss due to fuel transportation

Lignite coal disintegrates rapidly and does not possess a very high calorific value. Consequently, it is seldom economically possible to ship it for long distances, to be used for developing power. At the same time, there are excellent reasons for believing that central power plants, situated at the lignite areas in different parts of Western Canada, could economically generate and transmit power to towns and cities within a considerable radius of the fields.

The following table gives a comparison of fixed charges involved in power transmission and fixed charges on fuel transportation. The figures relative to freight rates on coal from the mines to the point of consumption have been calculated from Canadian freight tariffs. In Western Canada, the average freight rate on coal per ton-mile for a 100-mile haul is a trifle over 15 mills.

It will be noted from the table, that the annual loss by transportation of fuel from the mines to the point of consumption (100 miles) varies from $61,945 for a plant of 5,000 kw. capacity, to $346,674 for one of 20,000 kw. capacity. The conditions assumed in this table, however, are for a constant power load for 24 hours a day, and the comparison would not be as favourable if the load was only on for a portion of the day.

In any case, the figures are sufficiently startling to warrant an investigation being made as to the possibilities of central power plants at the lignite fields in Saskatchewan as compared with the present method of hauling bituminous coal long distances by rail to the markets in central Alberta and Saskatchewan.

Comparison of Fixed Charges Involved in Power Transmission and Freight Charges of Fuel Transportation

Power Station at Mines. Distance, 100 Miles from Point of Consumption. Freight, $0.015 Per Ton Mile. Coal, 4.0 lbs. per kw.h.

	Central Station Capacity		
Details of Construction and Losses	5,000 kw.	10,000 kw.	20,000 kw.
Right of way; Cost per 100 miles 50 feet wide.	$60,000 at 5% $ 3,000	$60,000 at 5% $ 3,000	$60,000 at 5% $ 3,000
Steel tower const'n. Cost per 100 miles; Twin circuit towers not including copper	$332,200 at 9% $29,898	$322,200 at 9% $29,898	$322,200 at 9% $29,898
Conductor; Cost for most economic line, Copper at 14c lb.	$70,000 at 6% $4,200	$140,000 at 6% $8,400	$280,000 at 6% $16,800
Kw.hr. loss on line; Cost of $0.003 per kw.hr.	$4,857	$9,714	$19,428
Transformers; Equal capacity at each end of line to carry load; Cost $15.00 per kw.	$150,000 at 15% $22,500	$300,000 at 15% $45,000	$600,000 at 15% $90,000
Total of fixed charges and losses	$64,455	$96,012	$159,126
Freight charges one year's coal supply	$126,450	$252,900	$505,800
Loss by transportation of fuel	$61,945	$156,788	$346,674

June 1, 1913

The Power Situation in a Western City

A choice of many power sources—Steam turbines with gas-fired boilers are favored—The gas-engine very economical.

The phenomenal development of the City of Calgary threatens to result in an acute situation with regard to adequate supply of power for present and future requirement. The Board of Commissioners however, have been quick to realize the needs of their rapidly growing city and some months ago engaged the firm of R. A. Ross & Company, consulting engineers, Montreal, to make a report on the general situation. This report was recently presented and inasmuch as it represents, in a very definite manner, a most interesting phase in western power development, we are pleased to be able to reproduce it in full. The report is as follows:—

Acting under your instructions, we have investigated and beg to report herein upon the power question in its various phases in the city of Calgary.

We were instructed not only to investigate and report upon the costs of power to be obtained from several sources, but also upon the power demands of the city, and to recommend a scheme of distribution which would be suitable for a rapidly growing western muncipality.

In pursuance of these instructions our Mr. Ross obtained in Calgary a great deal of detail information regarding the power situation, the probable demands for power and the approximate location of power centres, and made an inspection of the present civic power plant.

Up till the present we have been dealing with all the matters referred to above with the intention of embodying the results in one large report, but as the power situation has become very acute, and it becomes advisable for you to quickly decide upon the best method of handling this situation, we deal in this partial report only with the question of the costs of power developed by various methods, so that you may make your decision as to increases quickly, leaving to a later report all further matters relating to the power demand at present and in future, its centre of location, the best methods of transmission and distribution, and the lay-out of an underground system, etc.

With regard to the amount of power demand, although this will be dealt with in another report, in order to place you in possession of the scale of your requirements, we estimate that in ten years, when the city of Calgary will have attained a population of 200,000, you will have an output of from 40 to 45,000 kilowatts.

Under Eastern conditions this would appear an excessive allowance, but we might call attention to the fact that (1) you anticipate bonusing industries by means of cheap power, which will inevitably mean a large demand for power for industrial purposes; (2) that, owing to the cheap rates, electric light will be universally used, and (3) that your output will be more readily absorbed by new industries, which are not committed to any particular method of power development as in older established municipalities, where the industries are already supplied with their own power plants, all of which will tend to make your demands much higher than for a similar-sized municipality in the East.

In any case, however, the magnitude of your requirements is such that in future your plant should be increased in fairly large units, which we have placed at 5,000 kilowatts each, and if our expectations as regards your total requirements be met, an equipment of this size would have to be added about every year and one-half on the average.

Your present plant, while suited to past needs, is entirely out of scale for future requirements, owing to the small size of both boiler and engine units, but, inasmuch as it is in existence and will have to be used, whatever source of power be adopted for the future, we have left it out of consideration in the comparative costs of power to follow, knowing that it will add to each the same amount, and, therefore, not effect the relative costs.

This report, therefore, may be understood to deal only with the question of the comparative costs of power from different available sources, on the basis of a plant capacity of 45,000 kilwatts eventually equipped with 5,000 kilowatt units.

We have endeavored to place these sources of power on as directly comparable a basis as possible, and have assumed in every case an average load factor of 50 per cent., which we feel will probably be attained, owing to your heavy industrial loads and your widely extended street railway system.

In all the estimates and figures to follow we have considered the cost of power developed at the generator terminals, but have not allowed for switching, transmission, or any other item, as at this point the costs of the different classes of power are more directly comparable than at any other; further, we have assumed in every case that the plant will be located in its present position at Victoria Park, and increases will be met by extensions to the present buildings. This position with its ready access to water and coal appears to be decidedly the most favorable we have seen and is situated fairly in the centre of the load which may be anticipated.

If, however, another site should be determined upon than the above, this will not appreciably affect the relative figures of cost of power given herein.

Sources of Power

An investigation of the conditions existing in Calgary reveals several sources of power, which we consider in detail in the order given below:—

(a) Hydro-electric power by contract with the Calgary Power Company;

(b) Power obtained from coal fired boilers and steam turbine generator sets;

(c) Power obtained from natural gas-fired boilers and steam turbine generator sets;

(d) Natural gas engines operating generators;

(e) Combination of coal-fired boilers and steam turbines with power from the Calgary Power Company;

(f) Combination of gas-fired boilers and steam turbines with hydro-electric power from the Calgary Power Company.

(g) Natural gas engine power supplemented by power from the Calgary Power Company.

(a) Calgary Power Contract.

There is under negotiation at the present time a contract with the Calgary Power Company at the following rates:—

For the first	5,000 horse power,	$26 per year
For the next	1,000 horse power,	25 per year
For the next	1,000 horse power,	24 per year
For the next	1,000 horse power	23 per year
For the next	1,000 horse power	22 per year
For the next	1,000 horse power	21 per year
For all over	10,000 horse power	20 per year

Under this contract power is sold to the municipality at the sub-station of the Power Company in Calgary, and provided the city is properly safeguarded against interruptions, and also provided that the load is such that this power can be utilized continuously for twenty-four hours per day, the contract is a good one for the city to enter into; if, however, the power is unreliable and no effective guarantees can be obtained, the contract is not a good one for the city; further, if the city does not use this power for twenty-four hours a day the contract becomes of lessened value—by way of illustration—if the cost at $26.00 per horse power, which is equivalent to $34.50 per kilowatt year, can be used twenty-four hours a day and three hundred and sixty-five days in the year, making in all 8,760 hours, the cost per kilowatt hour will be 0.4c. If, however, the average use is only 50 per cent. of the hours above, then the cost per kilowatt hour is 0.8c—the latter being above what power can be produced for from several other sources, as will be seen later.

As a matter of fact, the loads which you will have within a year will absorb this power for the full twenty-four hours, so that our recommendation in this regard is to accept the contract, provided safeguards are introduced against interruptions, and that if the service is as unreliable in the future as it has been in the past, then that the contract may be cancelled.

(b) Steam Generated from Coal.

Under this head we have estimated upon 5,000 kw. units as follows:—

Boiler plant in 500 horse power units, with superheater, economiser, stokers, feed water heaters, feed pumps and draft fans, with stack, equipped with coal bunkers and coal and ash-conveyors;

Engine plant to consist of one 5,000 kilowatt steam turbine, with surface condenser, air and circulating pumps, operating at a pressure of 150 lbs. at throttle, 100 degrees of superheat and twenty-six inches of vacuum together with the necessary motor-driven exciters.

The above general specifications, which is intended to cover a modern economical equipment, may be varied in a number of ways when further study is given to the matter. As it stands, however, it is complete enough for use for comparative purposes with power produced in other ways.

We have estimated for each increase of plant in the capital and operating costs and fixed charges, the details of which are given in Table I. In making up these estimates we have used the prices paid for labor in your present plant, and for fuel have used the average price of coal under present conditions. From the table you will see that—

(1) The capital costs are estimated at $46.00 per kilowatt;

(2) The costs per kilowatt year, on a 50 per cent. load factor basis vary from $37.20 to $32.36;

(3) The costs per kw.h. on a 50 per cent. load factor basis, vary from 0.85c to 0.74c.

(c) Power from Gas-Fired Boilers.

In this case the plant will be identical with that described in case (b) above, with the exception of the omission of stokers and coal bunkers, but with the addition of gas burners and plain grates, by means of which boilers may be hand-fired with coal should occasion arise. We have used the same unit labor prices as in the case of coal-fired boilers, but have changed the boiler-room labor to allow for the use of gas in place of coal.

The gas we have assumed as costing 15c per thousand cubic feet of 1050 B.t.u. gas, and have made due allowance in the consumption for its superior efficiency per B.t.u. over that of coal, due to the fact that it may be burned with a smaller excess of air; that the boilers do not become fouled with soot; that banking is more economically carried out; and that loss of coal from the grates is eliminated.

Table II. summarizes the results, from which it will be seen that—

(1) The capital costs are $45.00 per kw.;

(2) The operating costs per kilowatt year on a 50 per cent. load-factor basis, vary from $31.38 to $27.34;

(3) The cost per kilowatt hour, at 50 per cent. load factor, varies from 0.71c to 0.62c.

(d) Natural Gas Engine Plant.

(1) The capital cost per kilowatt is $91.00;

(2) The cost per kilowatt year, at 50 per cent. load factor will vary from $26.46 to $24.13;

(3) The cost per kilowatt hour, at 50 per cent. load factor will vary from 0.60c to 0.55c.

The figures are given, in detail, in Table III.

(e) Combined Coal-Fired Boilers and Calgary Power Co.

Under this head we have assumed that one of the 5,000 kilowatt units, as indicated in case (b), is omitted, and power to that extent purchased from the Calgary Power Company, under the contract prices which are given in case (a).

If that contract be accepted you will have to pay immediately for 5,000 horse power and have the right to take additional power as required. We have therefore assumed that you finally take from them 5,000 kilowatts, or 6,667 horse power, and that this power is used for twenty-four hours on the base of the load curve and that the remainder of your requirements are met by the use of steam turbine generating sets and coal-fired boilers, as in case (b).

Under this condition, with the average load factor at 50

Table I.—Capital and Operating Costs:—Steam Plant Coal Fired

No. of Units	1	2	3	4	5	6	7	8	9
Capacity	5,000 kw.	10,000	15,000	20,000	25,000	30,000	35,000	40,000	45,000
Capital cost	$	$	$	$	$	$	$	$	$
Buildings, etc.	34,610	69,220	103,830	138,440	173,050	207,660	242,270	276,880	311,490
Boilers, etc.	78,000	156,000	234,000	312,000	390,000	468,000	546,000	624,000	702,000
Engines, etc.	93,250	186.500	279,750	373.000	466,250	559,500	652.750	746.000	839;250
Engineering contingencies.	25,733	51,465	77,198	102,930	128,663	154,395	180,128	205,860	231,593
Total	231,593	463,185	694,778	926,370	1,157,963	1,389,555	1,621,148	1,852,740	2,084,333
Operating costs									
Coal	120,560	241,120	361,680	482,240	602,800	723,360	843,920	964,480	1,085,040
Labour	30,036	30,036	31,934	40.351	44,950	46,270	49,920	49,920	52,767
Supplies, etc.	3,000	6,000	9,000	12,000	15,000	18,000	21,000	24,000	27;000
Maintenance	4,632	9,264	13,896	18,528	23,160	27,792	32,424	37,056	41,688
Depreciation	11,580	23,160	34,740	46,320	57,900	69,480	81,060	92,640	104,220
Total operating	169,808	309,580	451,250	599,439	743.810	884,902	1,028,324	1,168,096	1,310,715
Interest	11,580	23,160	34,740	46,320	57,900	69,480	81,060	92,640	104,220
Sinking fund	4,632	9,264	13,896	18,528	23,160	27,792	32,424	37,056	41,688
Total	186,020	342,004	499,886	664,287	824,870	982,174	1,141,808	1,297,792	1,456,623
50 per cent. load factor									
Cost per kw.h.	0.85	0.78	0.76	0.76	0.75	0.75	0.74	0.74	0.74

Table II.—Capital and Operating Costs:—Steam Plant, Gas-Fired

No. of Units	1	2	3	4	5	6	7	8	9
Capacity	5,000 kw.	10,000	15,000	20,000	25,000	30,000	35,000	40,000	45,000
Capital cost	$	$	$	$	$	$	$	$	$
Building, etc.	34,610	69,220	103,830	138,440	173,050	207,660	242,270	276,880	311,490
Boilers, etc.	70,500	141,000	211,500	282,000	352,500	423,000	493,500	564,000	634,500
Engines, etc.	95,750	191,500	287,250	383,000	478,750	574,500	670,250	766,000	861,750
Engineering contingencies	25,108	50,215	75,323	100,430	125,538	150,645	175,753	200,860	225,968
Total	225,968	451,935	677,903	903,870	1,129,838	1,353,805	1,581,773	1,807,740	2,033,708
Operating costs									
Gas	98,550	197,100	295,650	394,200	492,750	591,300	689,850	788,400	886,950
Labour	23,748	23,748	23,748	29,381	30,330	31,650	31,650	31,650	31,650
Supplies, etc.	3,000	6,000	9,000	12,000	15,000	18,000	21,000	24,000	27,000
Maintenance	4,520	9,040	13,560	18,080	22,600	27,120	31,640	36,160	40,680
Depreciation	11,298	22,596	33,894	45,192	56,490	67,788	79,086	90,384	101,682
Total operating	141,116	258,484	375,852	498,853	617,170	735,858	853,226	970,594	1,087,960
Interest	11,298	22,596	33,894	45,192	56,490	67,788	79,086	90,384	101,682
Sinking fund	4,520	9,040	13,560	18,080	22,600	27,120	31,640	36,160	40,680
Total	156,934	290,120	423,306	562,125	696,260	830,766	963,952	1,097,138	1,230,322
50 per cent. load factor									
Cost per kw.h.	0.71	0.66	0.64	0.64	0.64	0.63	0.63	0.62	0.62

per cent., and with the hydro power purchased being assumed as used on a 100 per cent. load factor, the load factor of the steam plant is one which will vary with every additional increase of plant, beginning with 20 per cent. and running up to 44 per cent., for which due allowances have been made in the costs.

It will be seen that the effect of the purchase power from the Calgary Power Company is to decrease costs very materially at the start, but thereafter the amount purchased becomes such a small portion of your whole requirements that the effect is not great.

The details of capital and operating costs are given for the various demands in Table IV., from which it will be seen that—

(1) The costs per kilowatt year vary from $26.34 to $30.45, on a 50 per cent. load factor basis;

(2) The costs per kilowatt hour, at 50 per cent. load factor, vary from 0.53c to 0.70c.

(f) Combined Gas-fired Boilers and Calgary Power Co.

The costs of power have been estimated in this case under the same conditions as for case (e), substituting gas for coal as fuel under the boilers.

As before, the steam turbine sets supply all the power demands of the City over and above the 5,000 kw. purchased from the Calgary Power Company.

The changing load factors on the steam plant occur as before and have been taken into consideration.

Table V. gives the figures of capital and operating costs under these conditions, from which it will be seen that—

(1) The cost per kilowatt year, on a 50 per cent. load factor basis, varies from $24.09 to $26.18;

(2) The cost per kw.h. on a 50 per cent. load factor basis, varies from 0.50c to 0.60c.

(g) Gas Engines and Calgary Power Company

The costs of power has been estimated in this case under the same assumptions as in the previous cases, (e) and (f), except that gas engines are substituted for boilers and steam turbine sets, and supply all the power requirements of the city over and above the 5,000 kilowatts purchased from the Calgary Power Company, as in the other cases.

The changing load factors on the gas engines also occur as in the previous cases, and have been taken into consideration in the estimates—the details of which are shown in Table VI. It will be seen from this table that—

(1) The cost per kilowatt year, at 50 per cent. load factor, varies from $25.08 to $24.72;

Table III.—Capital and Operating Costs:—Gas Engine Plant

No. of units	2	4	6	8	10	12	14	16	18
Capacity	5,000 kw.	10,000	15,000	20,000	25,000	30,000	35,000	40,000	45,000
Capital cost	$	$	$	$	$	$	$	$	$
Building, etc	78,900	157,800	236,700	315,600	394,500	473,400	552,300	631,200	710,100
Engines, etc.	327,500	655,000	982,500	1,310,000	1,637,500	1,965,000	2,292,500	2,620,000	2,947,500
Engineering contingencies	50,800	101,600	152,400	203,200	254,000	304,800	355,600	406,400	457,200
Total	457,200	914,400	1,371,600	1,828,800	2,286,000	2,743,200	3,200,400	3,657,600	4,114,800
Operating costs									
Gas	45,990	91,980	137,970	183,960	229,950	275,940	321,930	367,920	413,910
Labour	15,329	15,329	17,549	21,886	24,306	26,326	28,546	30,766	32,986
Supplies, etc.	7,000	14,000	21,000	28,000	35,000	42,000	49,000	56,000	63,000
Maintenance	9,144	18,288	27,432	36,576	45,720	54,864	64,008	73,152	82,296
Depreciation	22,860	45,720	68,580	91,440	114,300	137,160	160,020	182,880	205,740
Total operating	100,323	185,317	272,531	361,862	449,276	536,290	623,504	710,718	797,932
Interest	22,860	45,720	68,580	91,440	114,300	137,160	160,020	182,880	205,740
Sinking fund	9,144	18,288	27,432	36,576	45,720	54,864	64,008	73,152	82,296
Total	132,327	249,325	368,543	489,878	609,296	720,314	847,532	966,750	1,085,968
50 per cent. load factor									
Cost per kw.h.	0.60c	0.57c	0.56c	0.56c	0.56c	0.55c	0.55c	0.55c	0.55c

Table IV.—Capital and Operating Costs—Combined Calgary Power Company Service and Steam—Coal Fired

No. of steam units	0	1	2	3	4	5	6	7	8
Power generated	0 kw.	5,000	10,000	15,000	20,000	25,000	30,000	35,000	40,000
Power purchased	5,000 kw.	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Load factor of	%	%	%	%	%	%	%	%	%
System		60	50	50	50	50	50	50	50
Steam plant		20	25	33	37½	40	41½	43	44
Capital cost of		$	$	$	$	$	$	$	$
Steam plant		231,593	463,185	694,778	926,370	1,157,963	1,389,555	1,621,148	1,852,740
Operating cost									
Coal		53,597	130,205	253,979	377,753	501,661	625,301	748,674	872,850
Labour		20,565	23,193	27,457	33,025	36,243	37,182	40,028	43,028
Supplies		3,000	6,000	9,000	12,000	15,000	18,000	21,000	24,000
Maintenance		4,632	9,264	13,896	18,528	23,160	27,792	32,424	37,056
Depreciation		11,580	23,160	34,740	46,320	57,900	69,480	81,060	92,640
Total operating		93,374	191,822	339,072	487,626	633,964	777,755	926,186	1,069,574
Interest		11,580	23,160	34,740	46,320	57,900	69,480	81,060	92,640
Sinking fund		4,632	9,264	13,896	18,528	23,160	27,792	32,424	37,056
Total		109,586	224,246	387,708	552,474	715,024	875,027	1,039,670	1,199,270
Cost of purchased power	171,000	171,000	171,000	171,000	171,000	171,000	171,000	171,000	171,000
Total		280,586	395,246	558,708	723,474	886,024	1,046,027	1,210,670	1,370,270
Cost per kw.h.		0.53c	0.60c	0.64c	0.66c	0.67c	0.68c	0.69c	0.70c

(2) The cost per kilowatt hour, at 50 per cent. load factor, varies from 0.52c to 0.57c.

Producer Gas Power

It will be noted that no estimates have been made nor curves shown for the cost of power from producer gas made at the works and utilized in producer gas engines, the reason being, as very small amount of figuring will indicate, that the cost of producer gas at the prices which you have to pay for coal is greater than that of natural gas at 15 cents. To illustrate this matter we would call attention to the following figures—

Natural gas, of 1050 B.t.u. as furnished the municipality at 15 cents per thousand gives the following result:—

1000 B.t.u. x 1000 cubic feet = 1,000,000 B.t.u. for 15 cents = 66,666 B.t.u. for 1 cent.

If producer gas be used a battery of producers will have to be provided in addition to the gas engines, which are allowed for in the case of natural gas, and the fixed charges on these will have to be paid together with the interest, sinking fund, etc.—all additional to the cost by the use of natural gas engines.

It results, therefore, that a considerable saving will have to be made in the cost of producer gas per thousand cubic feet in order to make up for this increase. If we assume a producer efficiency of 80 per cent., which is high, the following table indicates the prices which would have to be paid per ton for coal at the plant in order to produce 66,666 B.t.u. for one cent, as is the case of natural gas. Column No. 1, Table VII., indicates heating value per pound of coal; column No. 2 indicates the heat value in the gas produced from one pound of coal; column No. 3, price per ton which would equate with natural gas price.

Table VII.

B.t.u. per pound coal	B.t.u. gas	Equivalent cost per ton
14,000	11,200	$3.36
13,000	10,400	3.12
12,000	9,600	2.88
11,000	8,800	2.64

Table V.—Capital and Operating Costs—Combined Calgary Power Company Service and Steam Gas Fired

No. of Steam Units.	0	1	2	3	4	5	6	7	8
Power generated	0 kw.	5,000	10,000	15,000	20,000	25,000	30,000	35,000	40,000
Power purchased	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Load factor of system		60%	50%	50%	50%	50%	50%	50%	50%
Load factor of steam plant		20%	25%	33%	37½%	40%	41½%	43%	44%
Capital cost of		$	$	$	$	$	$	$	$
steam plant		225,968	451,935	677,903	903,870	1,129,838	1,355,805	1,581,773	1,807,740
Operating cost									
Gas		41,588	102,492	202,323	302,154	402,084	501,989	601,647	701,714
Labour		17,781	18,657	21,972	22,848	26,139	26,139	28,335	28,335
Supplies		3,000	6,000	9,000	12,000	15,000	18,000	21,000	24,000
Depreciation		11,298	22,596	33,894	45,192	56,490	67,788	79,086	90,384
Maintenance		4,520	9,040	13,560	18,080	22,600	27,120	31,640	36,160
Total operating		78,187	158,785	280,749	400,274	522,313	641,036	761,700	880,593
Interest		11,298	22,596	33,894	45,192	56,490	67,788	79,086	90,384
Sinking fund		4,520	9,040	13,560	18,080	22,600	27,120	31,640	36,160
Total.		94,005	190,421	328,203	463,546	601,403	735,944	872,434	1,007,137
Cost of purchased power	171,000	171,000	171,000	171,000	171,000	171,000	171,000	171,000	171,000
Total		265,005	361,421	499,203	634,546	772,403	906,944	1,043,434	1,178,137
Cost per kw.h.		0.50c	0.55c	0.57c	0.58c	0.59c	0.59c	0.60c	0.60c

Table VI.—Capital and Operating Costs—Combined Calgary Power Company Service and Gas Engine Plant

No. of gas units ...	0	2	4	6	8	10	12	14	16
Power generated ...	0 kw.	5,000	10,000	15,000	20,000	25,000	30,000	35,000	40,000
Power purchased ...	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Load factor of system		60%	50%	50%	50%	50%	50%	50%	50%
Load factor of gas plant		20%	25%	33%	37½%	40%	41½%	43%	44%
Capital cost of gas		$	$	$	$	$	$	$	$
plant		457,200	914,400	1,371,600	1,828,800	2,286,000	2,743,200	3,200,400	3,657,600
Operating cost									
Gas.		19,710	49,275	98,550	147,825	197,100	246,375	295,650	344,925
Labour		12,233	12,233	17,549	17,549	24,106	24,106	28,546	28,546
Supplies		7,000	14,000	21,000	28,000	35,000	42,000	49,000	56,000
Maintenance		9,144	18,288	27,432	36,576	45,720	54,864	64,008	73,152
Depreciation		22,860	45,720	68,580	91,440	114,300	137,160	160,020	182,880
Total operating		70,947	141,316	231,111	321,390	416,226	504,505	597,224	685,503
Interest		22,860	45,720	68,580	91,440	114,300	137,160	160,020	182,880
Sinking fund		9,144	18,288	27,432	36,576	45,720	54,864	64,008	73,152
Total		102,951	205,324	329,123	449,406	576,246	696,529	821,252	941,535
Cost of purchased power	171,000	171,000	171,000	171,000	171,000	171,000	171,000	171,000	171,000
Total		273,951	376,324	500,123	620,406	747,246	867,529	992,252	1,112,535
Cost per kw.h.		0.52c	0.57c	0.57c	0.57c	0.57c	0.57c	0.57c	0.565c

10,000	8,000	2.40
9,000	7,200	2.16

It will be seen from the above that you cannot purchase coal at your plant of the heat values given at any such price as will enable producer gas to compete with natural gas on the basis of fuel alone, and when it is considered that in addition a capital investment will have to be made in the producer plant, which is not necessary in the case of natural gas and the fixed charges paid on this capitalization, together with additional attendance necessary for firing, scrubbing and cleaning gas, etc., added, it is quite evident that if gas engines are to be used at all natural gas is the proper fuel.

Inasmuch as this producer question has been raised very sharply, we expect to supplement this report with another one, dealing with the producer gas situation, but the above should be sufficient, without any further details, to indicate its standing in the discussion.

Hydraulic Power From Bow River

A scheme has been brought forward by the Alberta Development Company to utilize the fall of the Bow River, below St. George's Island. Certain maps and information have been given us in dealing with this matter—the idea being that the city should either purchase the rights and construct the four plants necessary or, possibly, purchase power from the company, they making their own installation.

If power can be purchased from this company at the same rates and under the same conditions as the proposed contract between the Calgary Power Company and the municipality, it should be acceptable to the city, and as the reports of the company indicate that at $25.00 per h.p. year they can make a reasonable profit, there ought to be no difficulty in having the scheme financed on the basis of a contract with the city, and the city would be safe enough in offering them the same terms that they have to the Calgary Power Company.

As regards the matter of the city taking over the rights and constructing the power plants; the information is not in sufficient detail to enable us to recommend the city in this regard, but we are making a fuller study of the matter, and will report more in detail later. In the meantime, however, we know enough to be certain that this power, even if developed, can not affect the recommendation contained herein, as it could not possibly be ready for use for a couple of years at least, and, in the meantime, an additional plant must be purchased to meet imminent needs.

Summing Up

The details of power costs under different methods of production being given, each under its own head, final results are summarized on the sheet annexed, entitled, "Curve of Cost of Power at Generator Terminals," and the vital facts are much more readily grasped by an inspection of this sheet than by the individual tables; and it should be noted that,—

(1) The scale is a very large one, so that differences in cost appear to be exaggerated upon first inspection;

(2) In every case a load factor of 50 per cent. has been used. A different load factor would change results—a lower load factor favoring steam and a higher gas;

(3) Power purchased at $26.00 per h.p. and used 24 hours per day reduces the cost of all systems up to 15,000 kw. but is beaten thereafter by the gas engine alone—the difference, however, being only about .02 of a cent per kilowatt hour;

(4) In the curve the costs in dollars per kw. year and per h.p. year are also given at the same load factor.

Recommendations

Our recommendations are:—

(1) To conclude a contract with the Calgary Power Company on the basis set forth above, provided reliable service is guaranteed;

(2) To purchase for immediate use steam turbines and boilers, as this is considered the only quick solution of the power situation, which is critical at the present time and may be intolerable next winter unless something is done quickly;

(3) For future extensions thereafter, if there is no change in the art in the next few years, steam turbines with gas-fired boilers will be our recommendation, in spite of the greater economy of the gas engine.

(4) Should the development of the gas engine or gas turbine or some other improvement, render it possible to utilize other sources of power than that recommended, there will be no difficulty in introducing it later when it is ripe.

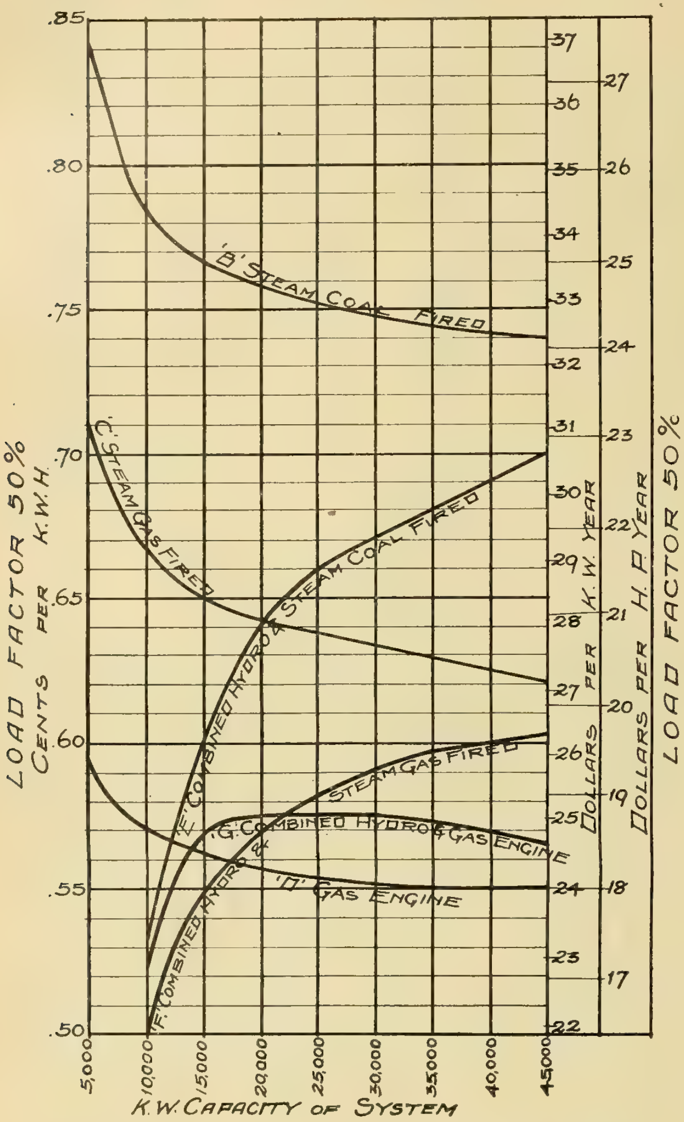
Our recommendations are as above in spite of the fact that the gas engine, from a power standpoint, is the cheapest.

In combination with hydro power steam from gas-fired boilers is cheaper than hydro and gas engine up to 20,000 kilowatts. The natural gas engine is hampered as follows:—

(1) The great capital investment being 100 per cent. more than for steam equipment;

(2) The whole service will depend upon the integrity of a pipe line 172 miles long;

(3) The large gas engine is not in such a stage of development as yet as will insure its success in your plant, and the use of smaller units would increase the capital and operating costs considerably over those indicated in our report.



Curves showing cost of power at generator Terminals.

The advantages of steam as compared with gas in this case are as follows:—

(1) The decreased capital cost involved;

(2) The utilization of natural gas with coal as a standby in case of failure of pipe line;

(3) The establishment of a plant in which every item has been tried out for years and in which no experimenting is necessary;

(4) The greater probability of quick deliveries of apparatus.

In conclusion we desire to call your attention to the necessity for immediate action in connection with this matter. By next fall you will have a load of 12,000 kw. and your equipment at the present time is sufficient for only about 6,000 kw. If a contract be concluded with the Calgary Power Company you will have an additional amount of power of 3,700 kw. There will, however, have to be purchased in any case 2,500 kw. of equipment of some kind, and, if the power contract be not concluded, there will have to be purchased a total amount of 6,000 kw. as the loads will approximate 12,000 kw. by about the first of November next, and you have virtually six months in which to order, have built, and installed this entire equipment—a time altogether too short already.

There is only one solution of this matter, and that is for immediate requirements, steam turbines with gas-fired boilers, as gas equipment can by no possibility be got within that time.

If you wish to investigate further the producer gas engine proposition for future extensions, this can easily be done, but to delay the installation of the present necessary plant further on this account is fatal.

Personal

Mr. Geo. C. Burnham has severed his connection with the firm of Kilmer, Pullen & Burnham, Limited, Toronto.

Mr. T. H. Nicholson, of the Bell Telephone Company, will be nominated for president of the Montreal Society by the nominating committee. There are now 360 members.

Mr. C. H. Mitchell, C.E., of the firm of C. H. and P. H. Mitchell, consulting engineers, Toronto, has been appointed a member of the Board of Governors of the University of Toronto.

Mr. F. Jno. Bell, general manager of the Canada Wire & Cable Company, sailed for London, Eng., May 17, by S.S Corsican, on business connected with his company. Mr. Bell will be absent six weeks or more.

Mr. R. A. Becker has been appointed supervisor of signals on the Eastern Lines of the G. T. R. Company, having charge of interlocking plants, automatic signals, electric crossing bells, etc., with headquarters at Montreal.

Mr. Jas. Veitch, formerly of Bruce, Peebles Electric Company, Edinburgh, and latterly on the staff of the Donaldson Liner S.S. Cassandro, has joined the engineering staff of Mr. Chas. F. Gray, consulting electrical engineer, 1005 Union Trust Building, Winnipeg.

Mr. W. D. Murrin until lately connected with the London (Eng.) United Railway has succeeded Mr. S. P. Thompson as mechanical superintendent of the British Columbia Electric Railway Company. Mr. Thompson, who came from New York, has returned to that city to enter into partnership with Mr. Roosevelt, who was formerly transportation manager of the B. C. Electric system.

Mr. George H. Harper, chief engineer and manager of the Brandon Gas & Power Company, which is one of the holdings of the Continental Gas and Electric Corporation, has been promoted to the position of chief gas engineer of the company at Cleveland. Mr. Roy Milhren, formerly of the Public Service Company, of North Illinois, and graduate of Wisconsin University, has taken the place vacated by Mr. Harper in Brandon.

Mr. W. F. Graves, late superintendent of track of the Chicago City Railway Company, has been appointed chief engineer of the Montreal Tramways Company. Mr. Graves, who has had a wide experience in civil engineering work, began his career with the Chicago, Rock Island & Pacific Railway in 1895, and after five years service in different departments was appointed engineer of maintenance of way of the Southwestern district of the company. Subsequently, he was engaged by the Missouri Pacific Railway as assistant engineer of maintenance of way, a position he held for three years. The next four years was spent with the South Side Elevated Railroad of Chicago as engineer of construction, and he was then appointed superintendent of track of the Chicago City Railway Company, where he remained for six years. Mr. Graves is a member of the American Society of Civil Engineers, the Traffic Club of Chicago, and the Chicago Engineers' Club.

High Frequency vs High Voltage Tests

In a recent issue we review a paper presented by Mr. Imlay & Thomas before the American Institute of Electrical Engineers on the subject of High Frequency Tests of Line Insulators. This paper reported the results of a number of interesting experiments which all went to prove that the behavior of insulators under high frequencies is not the same as their behavior under commercial frequencies and that the failure of a line is very often the result of a high frequency condition rather than of a high voltage condition.

At the same meeting Mr. P. W. Sothman, formerly chief engineer of the Hydro-electric Power Commission of Ontario, presented a paper describing comparative tests of high tension suspension insulators, this paper covering much of the work that had been done by Mr. Sothman in Ontario as well as the results of his wide experience gained before and since that period.

The discussion on these papers has been unusually interesting and general, showing that both these subjects are considered, by leading engineers, as of vital importance. We are able to print below extracts from the expressed opinions of a number of well known engineers on the matter contained in these two papers.

Mr. Ralph D. Mershon: There are a number of things in connection with the paper by Messrs. Imlay and Thomas that are not clear to me, and which I would like to have Mr. Thomas elucidate. For instance, in their paper there is shown a metal band around the insulator, and it is said that the effect of that metal band is equivalent to increasing the diameter of the pin. That is not quite clear, neither is it quite clear that putting a cap on the insulator is equivalent to reducing the diameter of the pin, the opposite effect of the band.

As to the change in voltage distribution over an insulator with change of frequency, I think there is no doubt about that, both from theoretical considerations and from measurements in connection with some high-voltage tests made at Niagara on which I reported to the Institute some time ago. These measurements were of the losses on insulators. The losses varied with the frequency. Inasmuch as other measurements made at that time indicated there was little, if any, loss in the porcelain of the insulator, it appeared that the losses measured were mainly confined to the surface of the insulator. And the only acceptable explanation for the variation of these losses with frequency was that as the charging current of the insulator changed with the different frequencies, the amount of charging current that had to flow over the surface changed, resulting in the change in the values of the losses. That change in loss would indicate a change in distribution similar to the one of which Mr. Thomas speaks, because change of loss, due to a change of charging current, means a change in the voltage absorbed on those parts of the surface over which the current has to flow in order to charge other portions of surface.

There can be little question in the mind of any one who has to do with transmission lines that the main point brought out in this paper is correct; namely, that the behavior of insulators under high frequency is not the same as their behavior under commercial frequencies. Again and again there are punctured in service insulators, which under test at commercial frequencies would flash over rather than puncture. This happens with wooden as well as metal pins, although it happens more frequently with metal pins. But you do not have to go to insulators to see there is a difference between action of high and low frequencies. You have seen a dry transmission line pole struck by lightning and shattered. Instead of taking the perfectly easy path through the air alongside the pole, the lightning preferred to go through the pole and smash it to pieces. I could understand how the lightning might choose a green tree with the sap in it, rather than the air alongside of it, but it is difficult to understand why it should prefer to go through a dry pole, which we have reason to believe would, if tested at commercial frequencies, flash over before it would pass any serious amount of current.

High-frequency tests should be continued further, and the endeavor should be made, when more knowledge as to these phenomena has been obtained, to connect up the effect of high-frequency tests with the results of tests at commercial frequencies. In other words, the endeavor should be made to determine what tests at commercial frequencies (either as to voltage or time, or both) would constitute an equivalent of high-frequency tests, so that tests can be made under ordinarily available conditions, equivalent to tests at high frequency.

In Mr. Sothman's paper rather undue emphasis seems to be laid upon factors of safety relative to the line voltage. It would seem that our experience, extending over a number of years, has shown that the problem of insulating a transmission line is not so much a problem of insulating the line voltage—that is comparatively easy—but the problem of insulating or protecting it against lightning or lightning effects.

On the last page of his paper Mr. Sothman has spoken in a rather discouraged way in regard to higher voltages. Now, while I agree with him that in some cases it would seem that higher voltages have been adopted than were justifiable, I think them unjustifiable on the score of economics rather than on the score of difficulties to be met with in operation. There is no particular reason to believe that the percentage of electrical troubles will be any greater with higher voltages, requiring an increased number of units in the suspension insulator, than there are now, though I can see some chance for a considerable increase in mechanical troubles.

Mr. Mershon then discusses at some length and somewhat mathematically the question of the distribution of the impressed voltage over a string of insulators and concludes.

It would seem, therefore, that in considering the voltage distribution over a string of insulating units the end unit condition previously discussed with reference to direct current must be taken into consideration, especially if the insulating units are placed close together. It is even more important when one comes to consider an insulator with more than one petticoat, because in this case the two or more petticoats give a result very similar to that of insulating units very closely spaced.

I believe, however, that the matter of string ratio and voltage distribution over the string is of a great deal less importance than that of the relation between the dry flash-over value and the puncture value of the unit. As previously stated, the problem of insulating the line against the voltage of the line is a comparatively easy one. The difficult part is to insulate the line against lightning. It is easy enough to put enough insulating units together to hold the voltage of the line. It is not so easy to get insulating units of such characteristics as will insure that there always be a flash-over rather than a puncture. And while it is desirable to have as good voltage distribution as possible, I consider voltage distribution entirely secondary in importance to a high puncture value of the units relative to the dry flash-over value of the unit. In this connection it is well to remember that a good voltage distribution with commercial frequencies does not necessarily mean a good one with frequencies equivalent to lightning, and that therefore the endeavor for a good voltage distribution at commercial frequencies is, beyond a certain point, a waste of time which might be much better devoted to the endeavor to increase the ratio of puncture value to flash-over value of the individual units.

Mr. P. M. Lincoln: Some of the deductions made by Messrs. Imlay and Thomas from the facts presented in their paper are deductions with which I cannot agree. In the first place, they use throughout this whole discussion the term "high-frequency tests." Now, they may be high-frequency tests or they may not be. There is not one iota of proof that the tests which they have described really do produce high frequency upon the insulator. The fact, if it is a fact, that high frequency exists on that insulator, is one that must be deduced entirely by inference. When a condenser discharges through a given circuit, if proper assumptions are made, one may infer that the discharge is alternating and of high frequency. Whether it is high frequency and alternating, or not, depends upon the amount of energy stored in the condenser as related to the rate at which this energy is dissipated once the discharge starts. It is my idea that if the discharge is alternating, the rate of decadence is so great that it is questionable whether the actual discharge is governed by the laws which govern alternating currents. When the rate of decadence is high, it requires only a relatively small number of alternations before the value of the voltage has dropped practically to zero.

It is admitted, however, that the method of testing as described in this paper does produce an exceedingly sudden application of voltage to the insulator, and one that exists for a very brief length of time. I believe it is due to the fact that the voltage exists on the insulator for such a very brief period of time, that we find the unexpected results which have been described by the authors,

There is one thing which has been omitted by the authors, and that is, a minute description of just how the voltage is applied. The authors state that the "application" exists for a period of one to two seconds, but there is no way of telling how many shocks the insulator receives during a single "application." It may receive one shock every alternation, in which event there will be some 200 or 300 shocks per application, or it may be that there is a shock only every tenth alternation, or some such matter, or it may be that there is a shock on the insulator a good many times per alternation. It would be interesting if we could have some data to settle this question.

The authors have submitted some " speculations," as Mr. Thomas has called them, by which they attempt to explain the results of the tests. They assume that in an insulator the distribution of voltage across its parts is determined by the fact that there is a resistance in series with a capacity, and that the very high frequency to which the insulator is subjected during the tests gives an entirely different distribution of potential over the insulator from what takes place when a frequency of 60 cycles is used. I have my doubts as to whether an analysis will show much weight to this contention. Suppose we have an insulator to which we apply a voltage. The voltage is brought by metallic conductors up to the material of the insulator itself Fig. **1.** This voltage appearing on the metallic parts of the insulator causes a current to flow. This current will flow due to two causes, first, because there is a capacity present, and consequently there will be a capacity current flowing through the insulator, and second, because the insulator is not a perfect insulator, but is to a slight extent a resistance, and consequently the voltage which appears will cause current to flow through that resistance. It is apparent that these two paths are not in series, but in parallel, so that any deductions which the authors make on the basis that the paths are in series will not apply. It is perfectly true that the current which flows through the capacity has a 90-degree lead over that which flows through the resistance, but I do not see that that has any particular bearing upon the case.

The tables given in the fourth, fifth and sixth pages of the paper by Messrs. Imlay and Thomas indicate that these so-called high-frequency tests were made with a transformer voltage which ranged between 300,000 and 350,000. Furthermore, the test on insulator "No. 1," indicated that the solid part of that insulator would break down at a voltage somewhere around 200,000. They could not obtain a breakdown on No. 2 insulator, since it flashed-over under oil, before breaking down, but it is fair to suppose that the solid dielectric of insulator No. 2 would break down at somewhere around 300,000 to 350,000 volts, because it is a well-known fact that the dielectric strength of a solid dielectric does not go up in proportion to its thickness and a dielectric two inches thick will not stand twice the voltage of a dielectric one inch thick. If the No. 1 insulator would stand 200,000 volts, it is fair to suppose that the No. 2 would break down at 300,000 or 350,000.

That is about the voltage actually in the transformer during the so-called "high-frequency" tests, and it is my opinion that the only thing which is observed in this breaking down on the "high-frequency" test is simply the result of a voltage of somewhere around 300,000 to 350,000 volts applied to the insulator, and that 300,000 to 350,000 volts is what breaks down the solid dielectric of that insulator. You may ask why it does not break down the air path, as when a 60-cycle current is applied. My answer, as suggested early in my discussion, is that the time of application is so short that the air does not have time to break down. Dielectrics break down in two separate and distinct manners. The first way may be likened to the breaking down of an oak plank by the penetration of a rifle bullet. That is the manner in which all solid dielectrics break down, and in which the air breaks down under certain conditions. It is my belief, from certain tests which I have seen made, that the breakdown strength of air from the "rifle bullet" method is not so far different from that of solid dielectrics as many suppose. Air, however, may break down in another way, that is, by ionization, but that method requires time. It does not act instantaneously. Ionization occurs by collision and is necessarily a progressive action, and it requires a certain appreciable amount of time for these collisions to extend from one terminal to another. Therefore, if the voltage is applied to the insulator with extreme suddenness, it may break down by the "rifle bullet" method before the parallel air path breaks down by ionization.

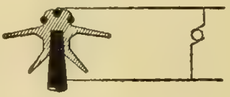


Fig. 1.

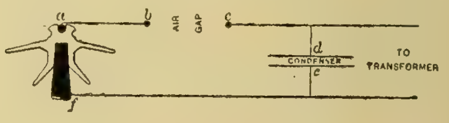


Fig. 2.

I think the statement by the authors that during the "high-frequency" tests not more than 100,000 volts was applied to these insulators, as indicated by the air gap, fails for the same reason. It requires time for the measuring air-gap to break down, and even if the air-gap separation indicates only 100,000 volts, I do not believe it follows necessarily that there was a pressure of only 100,000 volts present. It may have been a much higher voltage.

Another point which should be explained is the manner of determining the frequency of the attack upon these insulators. As I understand it, there is a condenser (d e, Fig.

2) connected in series with an air gap, c b, and the opposite terminal of the air gap is attached to the insulator, the pin f of which is attached to the other side of the condenser. It is my understanding that the million cycles per second which the authors have given as the approximate frequency of the voltage application to the insulator is that which will take place when the path is completed through the insulator; that is, the frequency is that determined by the condenser d e discharging through the inductance of the circuit d c b a f e. It should be noted that the current cannot flow through this path until the breakdown actually occurs. Until that breakdown occurs the frequency is determined simply by static capacity of the insulator discharging into the condenser d e through the path a b c d. In this case the frequency will be governed by this static capacity of the insulator and the inductance of the circuit a b c d. Since the static capacity of the insulator is exceedingly small compared to that of the condenser d e, the theoretical frequency is largely increased. Consequently, instead of a million cycles per second, we may have a theoretical frequency of many times that, possibly a factor of one hundred to one thousand. It is evident, therefore, that the duration of time of strain upon that insulator is exceedingly short, and, according to my conception, this does not give time for the air to ionize between terminals.

I agree with the conclusion of the authors that their tests have opened an exceedingly interesting line of investigation, and one which certainly ought to be followed up.

Mr. F. W. Peek, Jr., dwelt at length on the delay in a discharge through air when high potential stresses are suddenly applied, and discussed the paper of Messrs. Imlay and Thomas from this point of view.

At the moment before high-frequency discharge, or arc-over, the insulator is practically at zero potential. When arc-over occurs the insulator is thus raised very suddenly from zero potential to 325,000 volts, or possibly double this, above zero. This is well above the puncture voltage, as shown by the test under oil, and if this voltage had been gradually applied the stress at high points would have been gradually evened up by conducting air until arc-over occurred and the voltage across the insulator was reduced to zero. With the voltage suddenly applied the air does not become conducting to a great enough extent over the surface in time to relieve the insulators—hence, the porcelain is punctured. Complete puncture may not occur at the first application, but at first only cracks or chips in the porcelain, which gradually develop into puncture. If the petticoat is reduced as in the tests, the time lag for flash-over is reduced and less punctures should occur. There is still another effect which I have noted and which may have a bearing. If potential at low frequency is applied between electrodes and gradually increased, arc-over occurs and the potential across the gap drops to zero, as indicated by a voltmeter placed across the gap. In other words, the low-frequency arc "resistance" is practically zero. If, however, at a frequency of say 50,000 cycles from a generator the potential does not drop to zero, but may remain near the applied voltage, that is, the high-frequency arc seems in effect to have a very high resistance, or the high-frequency arc may play over an insulator surface without considerably reducing its potential below the applied value which may still remain above the voltage at which puncture would occur at any frequency, as under oil where arc-over is prevented.

The effect of the time lag of corona means that a good insulator under transient voltages must have a good balance. The suspension insulator should have high string efficiency, as brought out in my paper, previously referred to. This applied also to the parts that makes up the pin type insulator. There must also be ample margin between the low-frequency flash-over voltage in air and the puncture voltage under oil.

An interesting point is here brought up in design, or spacing of disks. If potential is gradually applied across a string of say five insulators (as usually spaced) and gradually increased, flash-over takes place first on the unit nearest the line, then over the second, third, and so forth. As there is a time lag for flash-over at each insulator this means that a gradually increasing potential is suddenly applied on the units, just as in the Thomas-Imlay tests. When the last insulator is reached the full applied voltage is for a short time before arc-over across the insulator. This is far above puncture voltage. I have observed insulators punctured in this way during arc-over tests. Thus with low-frequency surge the insulator nearest the tower may puncture. This shows the importance of good string balance, or of having the design such that all insulators will arc over at the same instant. Perfect balance is in the present design hardly possible, so, after designing for the best possible balance, the insulators should be so spaced that arc-over voltage from line to tower is just below the arc-over voltage around one unit.

Mr. Sothman in his paper has brought up many interesting questions. Regarding the question of test precautions, method of voltage control, power required, etc., I would refer to what I have said in the paper previously cited. I should like to add that while the needle gap has long been useful, we have about outgrown it, and it is not reliable above 100 kv. Unless proper corrections are made for humidity the variation is very great, and the voltages indicated are generally too high. This effect is not noticeable where the electrode is such that spark-over takes place before corona forms. Such an electrode should be standardized.

Mr. J. A. Sandford, Jr., speaking of Mr. Sothman's paper and the questions raised therein, said he believed the author had come quite close to the reason why insulators fail on the line even after the most thorough test possible at the factory when he says: "For it is quite probable that precautions now taken in one direction are often unwarranted and uncalled for, whereas, on the other hand, liberal allowances made in other directions may be of the greatest detriment to line and insulators." This seems to be forcibly brought out by the findings of Messrs. Imlay and Thomas as given in their paper. Mr. Sanford discussed these points under the headings, design tests, method of supporting insulator under tests, and wet tests, and says in conclusion:

The company with which the writer is connected has drawn up standard specifications for routine tests, which are used in all cases where specifications are not supplied by the purchaser. Voltages used of course depend on the insulator in question. The periods of time of test, so far as suspension units are concerned, we have fixed, as the variation in size of different insulators is not great; therefore the expense of testing is nearly the same for all styles we make. With reference to pin type, however, the sizes vary greatly, requiring voltages varying from 45,000 to 180,000 volts. The smaller insulators, particularly below 22,000 volts, do not need to be tested so long as the larger sizes, as each porcelain part in the smaller insulator is often as thick as in the larger, and the voltage per part very much less. Furthermore, a long time test on a very small insulator makes the cost of testing out of proportion to the price of the insulator.

The specifications which we have adopted are the result of our experience in testing porcelain insulators, combined with what we find is being asked for in specifications issued by different engineers. They are not as voluminous nor as exacting as some, nor as short and indefinite as others. We feel, however, that they are so drawn as to insure the purchaser against receiving defective material, without imposing undue hardships on the manufacturer.

In regard to two-piece insulators, I believe that the specifications may properly contain a statement as to the kind of cement to be used, and if Portland is specified, a statement as to the time of setting. As to the method of cementing, I believe this should be left entirely to the manufacturer, as it is right to suppose that if the manufacturer is following up his methods closely with a view to turning out the best possible product in the most economical manner, and at the same time fulfilling all guarantees made, he is in better position than the purchaser to say how the details of the work shall be carried out. This applies to all other parts of the work as well as the cementing, and will be found to vary in the different factories.

All insulators, whether pin or suspension type, should be tested after having been assembled and the cement is sufficiently set to allow of safe handling. There is a possible exception to this rule in the case of the very small two-part pin type insulators, as it is sometimes found advantageous to test these to flash-over when they come from the kilns, assembling the parts in the test pans without cement, thus testing both parts at once. Water is placed between the parts for this test. In the case of these small insulators it is then safe to cement the parts together and pack the complete insulators without further testing.

The paper by Messrs. Imlay and Thomas at once suggests that it may be desirable to introduce some sort of high-frequency test into the list of tests to be applied in order to make a selection of the proper insulator for a given set of conditions. However, I do not believe there are sufficient data at hand, at present, to allow us to say just what this test should be or how it should be applied. Further, I doubt the advisability of using the same apparatus for this test as is used for the commercial routine tests at the insulator factory.

Since it is coming to be generally acknowledged that the parallel test is the only good way to determine what is the most suitable insulator to meet a set of specified conditions, it seems to me that there should be available some place where such work could be done using the same equipment and conditions of test at all times. At present non-interested companies that are equipped, so far as apparatus is concerned, to make such tests, do not like to go to this trouble to set aside a space and rig up for the various tests, as such work does not pay them, and not having arrangements especially for it, there is more or less danger of injuring the apparatus.

If arrangements could be made with some laboratory or factory having the equipment and not directly interested in the sale or purchase of the insulators, in accordance with which this apparatus in a suitably equipped room could be available at all times, I believe that with proper use of such advantages there would be fewer mistakes made in insulating our transmission lines, and incidentally the owner of the equipment could derive considerable revenue from the making of comparative tests preliminary to the purchase of insulators for a transmission line, and from the use of such equipment for experimental and research work at very high voltages not at present possible except for experimenters connected with our large manufacturing companies.

We will be glad to give anyone copies of the specifications used by the company with which the writer is connected, or in any way to help in a movement for the standardizing of the specifications and the methods of tests on high-tension insulators.

Mr. R. F. Hayward: It is probably safe to say that no long-distance transmission line that has been equipped with insulators designed on any reasonable basis has ever experienced the slightest difficulty from rain or snow. This is absolutely true, at least, in the writer's experience. Consequently all tests of insulators for breakdown under artificial rain conditions, with ordinary frequencies, while being important, should be looked at more in the light of standard tests or strength of iron or steel or cement; in other words, something that has got down to more or less settled conditions.

In the writer's experience with high-tension transmission at 40 and 60 cycles over long distances and wide areas in Utah and Mexico, after eliminating breakdowns due to the mechanical destruction of insulators from outside sources, the only breakdowns of insulators that have passed through the standard tests have occurred in cases where there has undoubtedly been a high-frequency discharge of some kind or other, whether from lightning or as the result of some sudden surge, as from a heavy short-circuit.

Calgary Police System

The City of Calgary has recently awarded the contract for a complete police signal system to the Northern Electric & Manufacturing Company. The office will be of the type known as the Gamewell type "A" or Unit Type Central Office. The system derives its name from the fact that the main operating desk is so arranged that additional circuits may be added to the existing outfit at any time it is desired to increase the number of circuits on the system. Heretofore, the standard police signal operating desk has been built to operate a certain number of circuits and if the city where the desk was installed should grow to such an extent that it was considered necessary to install extra circuits, it was necessary either to buy a new desk for the required number of circuits or to build another central office which would take care of the extra circuits which had been added to the system. With the new unit type desk, which is built on the sectional book case principle, it is only necessary to buy the required number of units to take care of the initial installation. Should the city desire to install extra circuits, these units can be added to the existing desk. The desk being furnished the city of Calgary consists of 8 box units, 1 test unit, 2 flashlight units and 1 stable unit.

Other apparatus supplied the city is as follows:—1 P.B.X. telephone board which will be arranged to handle all telephone calls received by the police department. This will not only give communication between any of the police officials and the city telephone exchange, but will give intercommunication between any two officials or between any patrolmen calling from a street box to any police official. Auxiliary equipment also includes 70 exemplar police boxes, 41 flashlight brackets, complete, 70 6 in. double vibrating gongs, and 29 combination street posts, complete. The posts will be arranged for mounting both the police signal and fire alarm boxes which are located on the same corner. At the top of the post there will be a two-light fixture having a red and a green globe. The red globe will be illuminated at night at all times to indicate location of the fire alarm box, but the green globe will be illuminated only when the central police signal office wishes to call a patrolman to a signal box to receive instructions.

There will also be installed 70 relays for operating call bells and green lights, 1 motor-generator set, a storage battery board and storage battery rack, and 6 telephone sets for the officials' offices.

The central office will be installed by the Northern Electric & Manufacturing Company, while the outside line work, erecting of pedestals, mounting of boxes, etc., will be done by the city. The installation as a whole will be the States. At the present time there is only one other installation similar to the one Calgary is installing, this being at Elizabeth, New Jersey.

Testing of Telephone and Telegraph Lines

A Series of Short Articles Based on the Author's Practical Knowledge and Experience—Applicable to Plant of Any Size or to Any Manufacturer's Equipment

By Mr. T. H. Nicholson

A large proportion of the cost of maintaining telephone and telegraph lines is chargeable to locating and clearing the troubles that inevitably occur on the outside plant due to conditions that cannot be controlled economically, to the extent of eliminating such troubles altogether; so, any methods, either particular or general, that will tend to reduce the cost of locating these troubles, and clearing them, should be adopted as producers of so much revenue. This is true not only of the actual cost of locating and clearing trouble, but also of the lost time on the line where the trouble occurs, either to the owner for tolls, or to the subscriber for service.

If trouble occurs on the lines of an electric light plant the only thing that can usually be done is to go out and systematically search for the trouble. This is due to the numerous multiple circuits on such lines and to the very uncertain condition of them. If they were all known to be fully loaded—that is, with all lamps, etc., turned on, and the various values of the load known, it would be possible to locate any ordinary trouble from the central station by various means, but failing this the electric company is usually foresighted enough to have some data of their lines which will indicate points at which trouble may be expected.

With telephone and telegraph lines it is always possible to know what should be on them, and, as a result, a test can be made to see if this known condition exists, and if not, why; but on the other hand, there are a large number of telephone and telegraph offices in which little or no attempt is made to do this, those responsible preferring to take the cruder method of actually "looking for" the trouble.

It is the purpose of this series of articles to point out methods that can be used to indicate the nature and location of troubles as ordinarily encountered on telephone and telegraph lines. These methods will be explained and illustrated in such a manner that they can be readily combined together so that a complete testing outfit suitable for the largest and most varied equipment can be designed from them, or any one particular testing circuit can be made up for use as desired. The possibility of cutting down the time required to locate and clear trouble by the quick and accurate location of them will be the determining factor in the choice of methods in all cases.

Records

One of the most important aids to the clearing of trouble is an efficient and easily operated system of line records, so much so indeed, that an otherwise perfect maintenance organization is seriously handicapped without them. It is often claimed that modern record systems are so elaborate that they cost more to keep up than would be necessary for additional time spent on troubles cleared without their aid. In some cases of poorly organized record systems this may be true, especially when they are considered as completed when first put into use, instead of periodic inspection being made of them and occasional study to ascertain if any features have outlived their usefulness or if it is evident that some data frequently required is lacking.

It has been found that the card system of records is the most suited to this particular work and the prospective user has a large choice of arrangements to select his outfit from. In general it will be found that a uniform size card will give the best results, especially when a large variety of circuits or groups of lines have to be recorded. By so doing it is possible to have a very flexible and elastic arrangement capable of being redistributed or enlarged when necessary without the user being obliged to transfer information from one set of cards to another. This is especially emphasized to warn prospective users against the too common fault of starting a system with small cards and later finding the necessary information cannot all be included on them.

The 5 x 8 card seems to be large enough for all practical purposes and it can be obtained in a large variety of forms. Nearly all card manufacturers carry this size card in a large assortment of colors and with a choice of rulings that can be made to fit any condition. For large users, of course, it is better to design a ruling that is just what is required and to include printed headings for the guidance of users that would be lacking from regular stock cards.

Information on Cards

For telephone lines the cards should be grouped numerically and corresponding to the line numbers. Each line should have a card and if there is more than one station on the line a separate card should be provided for each, so that information particular to one may be recorded without being confused with any other. The upper part should have the number, name and address of the subscriber, together with details of the substation equipment. A space should be provided for the cable or lead, the conductors, the terminal boxes, the resistance to terminal boxes and to station, and the normal line capacity. Details of central office connections should also be provided for—in short, the complete record of the line. The lower part and back of the card can then be devoted to a record of the troubles that occur on that line, together with the cause of them.

In like manner a card record should be kept of all groups of lines and apparatus such as office trunks, desks, positions, etc. It does not take long, if these cards are made up when lines or apparatus are being installed, to secure the necessary information and much valuable time may be saved, not only to the maintenance force but also to the line or piece of equipment in question, when some trouble arises and it is possible to ascertain at a glance just where such and such a terminal is or what should be on a line.

Auxiliary Information

These cards are augmented in well organized systems by various means, such as by specially prepared or marked maps showing the exact location of terminals, etc. In smaller offices these may simply consist of sketches made on blank cards and filed together with appropriate headings for their identification. These sketches are especially valuable in the case of rural lines or signal system that have many branches. In such cases a complete sketch is made showing the length and resistance of each branch under normal conditions and when trouble occurs the cause can be readily located with the results of a suitable test compared with the data shown on sketch. Some examples of the use of these will be given in later chapters under actual working conditions, as well as some of the other forms of data described.

Apparatus

The success of a testing equipment depends to a large extent on the careful selection of the testing apparatus to be used, and it is certainly the worst part of a plant in which to practice economy by the purchase of unsuitable apparatus or cheap instruments. It is not meant by this that the high priced and elaborate instruments sometimes found catalogued are necessary, but it often pays to get a reliable make even if it does cost twice as much as apparently similar types of less known makers.

It is difficult to obtain equipment specially designed for telephone testing that is entirely suited for the system it is supposed to represent. The development of the telephone and its associated equipment has not yet reached a stage where the designers can afford to devote the necessary time to a study of this important question, so it is left in the hands of users to work out their own salvation.

In small offices it is usually satisfactory to arrange the testing equipment in the form of a wall set, the apparatus being simply mounted on the face of a panel or perhaps directly on the wall. If keys mounted in individual cases are available this is the better course, as it leaves the wiring open, and easily inspected or changed when necessary. In some pretentious offices a box to mount on the wall may be made up and the apparatus, mounted flush, with coils, condensers, etc., arranged inside.

When it is necessary for the testman to use the testboard all or a greater part of his time, it becomes desirable to have it in the form of a switchboard with a regular keyboard and jack panels. Such a testboard is easily made up from a discarded section of the regular switchboard, or from a branch exchange section. In offices that have a blank end position on the switchboard it can be used to advantage for this purpose, without destroying its value as a regular position when extensions make its regular equipment necessary.

(To be continued).

Storage Batteries in Telephone Work

"The application of storage batteries in telephone systems," was the subject of a paper read by Mr. H. W. Beedle, power engineer, Bell Telephone Company, at a meeting of Montreal Electric Society. Mr. Beedle described the development of the speech transmission circuit, and went on to say that the common battery is used incidentally for many signalling circuits, as it is a convenient source of power, and its low reactance feature prevents the fluctuations due to the operation of relays, etc., reaching the subscribers' receivers when their lines are in simultaneous use.

It would seem that with its advantages, the common battery system should be universally used, but it is found that the investment for the more expensive equipment and attached power plant is not generally warranted in isolated offices of less than 400 or 500 subscribers stations; that is: the increase in fixed charges over the local battery or magneto type of board is greater than the resulting economies in the power supply.

Since a storage battery is not a generator of electric power, but must be restored by returning the power taken out, means must be provided for charging. This is usually a generator driven by a motor or other source of power, but mercury arc rectifiers are often used where the capacity required is less than 50 amperes. Again because of the low reactance of the lead battery it is possible to charge it while connected to the load, as it will absorb the unavoidable irregularities in the current from the generator due to commutation and irregular magnetic field distribution. Special machines are required, however, and they have usually three separate and complete armature windings, and a large number of commutator bars.

Where noise on the system is experienced in spite of these precautions in design, and always in the event of arc rectifiers being used, there is a choke or retardation coil inserted in one lead of the charging circuit, which has the effect of smoothing out the current, at the expense, of course, of efficiency.

The storage of energy possible in the battery is naturally of great importance. The demand or load on the office is by no means constant throughout the day, and it would not be economical to run the charging machine continuously so that the battery would simply act as a low reactance bridge for the circuits, as the average efficiency of the machine would be low. It is therefore desirable to run the charging machine during only those hours when the demand from the circuits added to the current which the battery may properly receive equals or exceeds the rating of the generator. This practice is quite feasible in the larger equipments, but may require modification in some cases on account of the rate basis on which power is obtained. Reliability of the power supply is also to be considered, and where it is questionable provision can be made for the probable interruption by installing additional storage battery capacity.

Excepting what are know as private branch exchange boards, and which vary greatly in size and current demand, there are three general types of common battery switchboards in use:—No. 10 with an ultimate capacity of 1,600 stations; No.1-49 Jack with an ultimate capacity of 5,600 stations; No. 1-92 Jack with an ultimate capacity of 10,400 stations.

The storage battery equipment supplied and considered standard for these boards is as follows:—No. 10 boards—one No. 1 battery: 11 cells, capacity 400 amp. hours; one No. 2 battery: 11 cells, capacity 80 amp. hours; No. 1-49 Jack board: one No. 1 battery, 11 cells capacity 800 amp. hours; one No. 2 battery: 11 cells, capacity 200 amp. hours; No. 1-92 Jack board: one No. 1 battery, 11 cells, capacity 3,200 amp. hours; one No. 2 battery, 11 cells, capacity 200 amp. hours. In all these offices the No. 2 battery is used in series with the No. 1 battery to make up a 22 cell battery in order to increase the current through the subscribers' transmitter circuit, when a long distance connection is established.

Private branch exchanges are small switchboards in many respects similar to and in a few cases larger than those mentioned above as standard common battery boards. While conditions sometimes require that they be equipped with a power plant, they are usually supplied over ordinary cable pairs, No. 22 gauge, from the central office to which they are connected.

In case an individual plant is installed a storage battery is included just as in a central office, and where power is required in any considerable amount or the requisite cable pairs are lacking a floating storage battery is installed at boards fed from a central office. The purpose of this floating battery is to equalize the demand for current from the central office; the battery discharging during the day and re-charging at night when the load is at a minimum on the private branch exchange.

Message Taken "in absentio"

Engineers of the French Government telephone system have recently made some interesting experiments, with a view to avoiding inconvenience to persons who are absent from their offices or domiciles when others desire to communicate with them by telephone.

The experiments were made with a certain number of subscribers on the Wagram Exchange at Paris, to whose telephonic apparatus was fitted a special magneto. On turning the handle of this magneto a lamp lights automatically at the desk of a special employee who on receiving the signal, cuts off the connection with the subscriber's number, receives all the calls himself and notes down such communications as persons calling up that subscriber in his absence are willing to give him. On the return of the subscriber, another turn of the handle of the magneto notifies the special operator that the subscriber can receive further calls, and all communications received during his absence are immediately transmitted to him.

The engineers state that the system is technically a great success, and the question of putting the trials to practical effect by offering the same advantages to all subscribers is under earnest consideration.

Automatic Telephones in Australia

In 1912 the first automatic telephone switchboard was installed in Australia, the work being carried out under the supervision of a representative of a United States firm, to whom is due the credit for the introduction of the system to the Commonwealth. Gellong, in Victoria, was selected by the authorities for the initial experiment. As the result of the satisfactory working of that exchange, 20 suburban exchanges near Sydney are to be similarly equipped and there is every probability that before 1913 has closed still further expansions of the automatic service will be inaugurated.

The Bell Telephone Company have increased the schedule of wages for their operating staff in Montreal and Toronto. The rates vary from $7 per week for beginners to $10.50 for senior operators; $12 to $15 per week for supervisors, senior supervisors, and night chief operators; and from $16 to $22 per week for chief operators.

The Ocean Telegraph Act

A bill was given its first reading at Ottawa on May 5th, providing for more advantageous telegraphic communication between Canada, the United Kingdom and other parts of the British Empire. The bill provides for the appointment of a board to be known as the "Government Ocean Telegraph Board," which shall consist of the Postmaster General, the Minister of Marine and Fisheries, the Minister of Railways and Canals, and the Minister of Public Works. This board shall have charge of the enforcement of the new act.

The text of the bill includes an agreement made with the Universal Radio Syndicate, of London, Eng., for radio-telegraph communication between the above British possessions. This syndicate shall erect the necessary wireless stations and inaugurate a social, press, commercial and government service. The rates for messages sent in both directions between Montreal and any part of the United Kingdom are to be as follows:—

(a) Not more than 4d. per word for messages in plain language (not deferred).

(b) Not more than 8d. per word for code messages.

(c) Not more than 2½d. per word for government messages.

(d) Not more than 2d. per word for press messages.

One of the stations is to be built at some point in the province of Nova Scotia or New Brunswick. The syndicate will have an office in Montreal and will transmit at its own expense all the messages between Montreal and this Maritime station. Special rates from all points in Canada to Montreal are given and are outlined in the bill. The government reserves the right to take over these stations at any time.

It is announced by Mr. H. W. Baxendale, managing director of the Universal Radio Syndicate, with whom the above agreement has been made, that although the terms of this agreement do not require the service to be in operation inside of twelve months, it will actually be ready for operation during the early autumn of the present year.

An Unusual Water Power Station

In connection with the construction on the White Salmon River, Washington, 75 miles east of Portland, Ore., of the 20,000 h.p. hydro-electric development it was found necessary by the Stone & Webster Engineering Corporation to establish a temporary hydraulic plant for the purpose of furnishing power for carrying on the work incident to the building of the large plant.

A power flume 9 ft. 3 in. wide, built of wood, diverts water from the stream right through the new 125-foot dam now in process of construction, carrying it to a point a few hundred feet below the dam where the small wooden power house has been established operating under a 13-foot head of water. The prime mover is a 54-in. turbine built by the S. Morgan Smith Company, and capable of delivering at 13-foot head a maximum of 300 h.p. This is direct-connected to a generator rated at 150 kw., 440 volts. The electric power is used for various purposes on the immediate work including quarrying on top of the hill 400 ft. above the dam, operating concrete mixers, lighting, drilling, etc. It is also used at a point more than a mile down the river where the power house is being built, and to which point it is transmitted at 6600 volts. The depth of water in the flume is kept at 6 feet by an ingenious arrangement of gates such that when the water falls below 6 feet a by-pass is closed and the flow is built up; when the water tends to exceed 6 feet the by-pass is opened wide and the excess water thrown into the bed of the stream between the big dam and the temporary power house.

This development will have a head of 175 feet and an impounded volume of forty million cubic feet of water (1,250,000 tons). The water is gathered from a drainage area of 350 square miles and is held back by a concrete dam of the solid gravity type, 470 ft. long with a 250 ft. spillway measuring 125 feet high. Water will be carried from the dam to the power house by a wood stave pipe 5,100 feet long and 13 ft. 6 in. in diameter, emptying into a concrete forebay. From this point two pressure pipes 700 ft. long and 9 ft. in diameter will give the operating head of 175 feet. The purpose of the development is for lighting and power in Portland and vicinity.

Mr. Marshall Resigns

The resignation of Mr. T. P. Marshall as Superintendent of Stations, of the Toronto Electric Light Company, Limited, was marked by a very pleasant and enjoyable evening at his home at 225 Booth avenue, Toronto, when a large and representative deputation of the Operating Department presented him with a leather couch as a token of their regard, and regret at the severance of his connection with the firm. The presentation was made by Mr. W. O. Neelands, one of the oldest operators of the firm, who in the course of a few well chosen remarks expressed the feelings of the whole staff at Mr. Marshall's retirement, and cordially wished him and his wife all possible prosperity and happiness.

Mr. Marshall, who was taken completely by surprise, expressed his thanks in a manner which indicated how much he regretted leaving those with whom he had been associated for so many years, and the organization of which he wast justly proud. He referred to the many changes he had seen during his experience with the Toronto Electric Light Company, a period of service which has extended for over twenty years. That he should have risen to the high position, which for personal reasons he is now vacating, is the best indication of the esteem by which he is held both by employer and employee.

He related some amusing anecdotes of the troubles experienced from time to time in the development of the system, and the evening was passed in a very pleasant manner by all present.

Electric Railways

Trunk Line Electrification

A valuable paper was recently presented before the American Institute of Electrical Engineers, New York, by Mr. Charles P. Kahler, on the subject of "Trunk Line Electrification." A review of which is given herewith. This paper is especially interesting on account of the figures of initial cost and of maintenance that have been compiled for a typical road. The problem of steam road electrification is one of the biggest that electrical engineers will have to deal with in the next few years.

The great objection to operating many of the large steam railroads by electric power is the extreme heavy investment necessary for the electric apparatus and equipment. The ability of the steam locomotive, to handle railroad traffic in a very reliable, and, I may also say, expeditious manner, is very well known, but up to date, railroad managers either have not been convinced that electric motive power is as reliable as steam power or else they do not believe that the improvement in the railroad service or the saving in operating expenses resulting from electric operation will be great enough to warrant the heavy expenditures necessary. On most railroads, bonds would have to be issued to cover the cost of electrification, and the return on the investment, by reason of the lower electric operating cost, would have to be great enough to pay the interest and sinking fund on the bonds, and leave a reasonable profit besides.

The object of the paper is to show the effect of the substitution of electric motive power for steam, upon the operation of a railroad, and the comparative cost of operating a railroad by steam and electric power; also to outline general railroad conditions and show whether the return on the large investment necessary for the electrification of a steam railroad (by reason of the lower electric operating expenses and increased passenger earnings) will be likely to warrant operation by electric power.

Past Electrification Work

Very little of the past work of steam railroad electrification was done on account of the financial return expected on the money so expended. It was the ability of the electric locomotive to accomplish or do some special work not possible with the steam locomotive that caused most of the past work to be done. The first heavy electric railroad work in this country was on the B. & O. R. R., where the electric locomotives were substituted for steam locomotives to do away with the smoke troubles in the long Belt tunnel extending under the heart of Baltimore. The smoke trouble with steam locomotive has, in fact, been one of the most important reasons for the past progress in heavy electric railroad work. Steam locomotives, with their smoke and gases, could hardly do the work of the Pennsylvania electric locomotives operating through the tunnels into New York. The smoke nuisance is also the principal reason that the electrification of the Chicago terminals is being considered at present.

Irrespective of what caused the past heavy electric railroad work, the actual operation of large electric locomotives showed that they could in some ways handle railroad traffic more advantageously than steam locomotives. Also, it was found that electric locomotives were as reliable in operation as steam locomotives. In fact, the published records of the steam and electric locomotives of the New York Central Railroad, the New York, New Haven & Hartford Railroad, and the Pennsylvania Railroad, indicate that electric locomotives are probably even more reliable in operation than steam locomotives. The published records of the above roads also indicate that the quantity of fuel required to generate power in a steam-electric plant for railroad operation is much less than the fuel required by steam locomotives in the same service. Also, the locomotive repair expense was found to be much less on electric locomotives than on steam locomotives.

Further, as the electric locomotives do not have to bother with taking fuel and water, nor have a boiler or firebox to be cleaned out, they are nearly always ready for service, and also take less time to handle trains that steam locomotives, especially on long runs. The perfection of the multiple unit control made the number of driving units which could be controlled by one man practically unlimited and, consequently, it was possible to make the size of electric locomotives much greater than steam locomotives with the boiler limitations.

The large saving in operation and other advantages which it was evident would result from electric railroad operation, caused the manufacturers and builders of steam locomotives to make many marked improvements in the steam locomotives. The Mallet and Mikado types of locomotive, with all the refinements for economic operation, resulted partly from the competition between the steam and the electric locomotive. However, the limitations imposed by the boiler of a steam locomotive are still a big disadvantage, as any increase in tractive power of a steam locomotive can only be had by lowering the speed.

Another important point in connection with electric operation was brought out by the great success of the interurban electric railways. The frequent passenger train service, and other advantages possible on the electric railways, caused a large increase in the local passenger traffic. The passenger earnings on these interurban electric railways soon after beginning operation became much greater than had been obtained from the same territories by steam-operated railroads.

The gasoline motor car and the gas-electric motor car would probably not have been developed were it not for the trolley lines taking local passenger business away from the steam railroads. These have been successful as far as operation goes, but although some of the published costs of operation are lower than steam train operation, I know of several cases where the operating and maintenance costs of the gasoline motor cars differ very little from those of the three car steam trains. The gasoline cars are not as reliable as a steam locomotive, and I doubt if the gas-electric cars are much better, although they are probably better fitted to handle traffic where frequent stops are necessary than the gasoline cars.

Effect of the Physical Characteristics of a Railroad on the Operating Expenses

The grades, curvature and other physical characteristics of a railroad have a very important influence upon its operating expenses and are usually very carefully studied by railroad men with a view to cutting down operating expenses. The reduction in the number of freight trains by cutting down the ruling grade is one way of reducing operating expenses. The elimination of helper engine districts, shortening of distances, taking out curvature, and lessening the rise and fall of grades, are other ways in which a great deal of money is now being expended on steam railroads to lower the operating costs.

Ruling Grade—The ruling grades are those which limit the weight of the freight trains. They are not always the maximum grades, because the maximum grades are often momentum grades. On many steam railroads where the average grade is low, the heavy ruling grades which determine the weight and thereby the number of freight trains, are comparatively short. If these roads were electrically operated, the weight of the freight trains could in most cases be made much heavier than possible by steam operation, on account of the characteristic of the electric locomotive to operate overload without dangerous overheating, long enough to get over the short heavy-grade sections, and on this account the ruling grade of an electrically operated railroad will seldom be as great as the ruling grade of a steam-operated railroad. This will be explained more in detail below.

Helper Districts—Sometimes in constructing a railroad on a certain ruling grade, there are some short sections where it is either impossible to build to the established ruling grade or else the construction expense would be prohibitive. In such cases, helper districts are established which require from one to four engines, in addition to the regular road engine, to haul freight trains with the maximum or ruling grade tonnage over them. For instance, if the ruling grade of an engine district is 0.5 per cent. and there is a 1.7 per cent. helper grade, while one engine could haul a freight train loaded for a 0.5 per cent. grade over the engine district, two additional locomotives of the same class as the road locomotive would be required to assist the train over the 1.7 per cent. helper district. Only one engine crew would be required where more than one electric helper locomotive is used, as two or more electric locomotives can be coupled together and operated as a single unit by one man, while with steam locomotives as many engine crews will be needed as there are steam locomotives used.

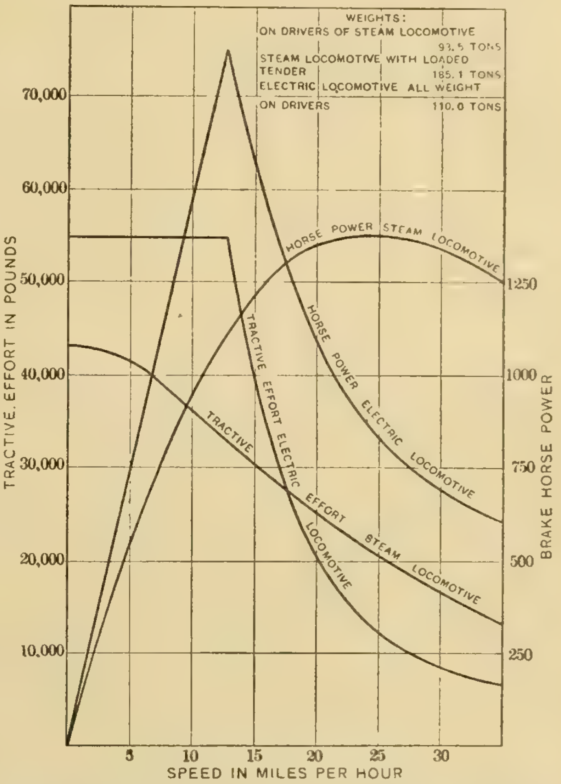
Influence of the Locomotive on the Operating Expenses of a Railroad

The locomotive is directly responsible for from 30 per cent. to 40 per cent. of the operating expenses of a steam railroad. The principal items being the fuel cost, locomotive repair cost, the engine house expenses, and the wages of the engine crew. In addition, the locomotive is indirectly responsible for a good deal of expense, as its tractive power determines the number of freight trains, and upon its reliability depends the expense due to delays from locomotive failures.

The horse power and tractive effort curves shown in Fig. 1, for a consolidated steam freight locomotive and an electric locomotive for freight service, illustrate the comparative characteristics of the two kinds of locomotives. At a speed of 16.5 miles per hour, which is only a little greater than the usual average speed of freight trains, the tractive power of both locomotives is equal. Above this speed the steam locomotive, can exert a higher tractive effort than the electric locomotive, while below this speed the electric locomotive has the higher tractive effort.

The steam locomotive can exert the tractive effort shown by the curve at the higher speeds only for short intervals, on account of the inability of the boiler to continuously supply the necessary steam. On the other hand, the electric locomotive can not continuously exert the high tractive effort shown by the curve at low speeds without overheating. The maximum tractive effort which can be continuously exerted by the electric locomotive with safety is 34,600 lb. at a speed of 16 miles per hour. Below this speed the high tractive efforts shown can only be used for certain periods of time. Thus, for one hour, 45,000 lb. tractive effort can be exerted without overheating the motors, with the speed at about 14 miles per hour.

At starting, as much as 55,000 lb. can be exerted by the electric locomotive, while the steam locomotive can, under favorable conditions, only exert a tractive effort of about 43,000 lb. at starting. One of the causes of the higher power of the electric freight locomotive at starting is that all its weight, 220,000 lb., is on the drive wheels, while although the steam locomotive with loaded tender weighs 185 tons, it has only 187,000 lb. on the drive wheels. Also the coefficient of adhesion is greater for an electric locomotive than for a steam locomotive.



Curves showing comparative characteristics of electric locomotive and consolidated steam locomotive for freight service

The foregoing shows the characteristics of steam and electric locomotives and should give some idea of their respective abilities to handle the traffic of a steam trunk line railroad. As stated before, the weight of the steam freight trains is generally determined by the ruling grades. As an electric locomotive can exert a high tractive effort for short intervals without dangerous overheating, the average grades, which are usually much lower than the ruling grades for steam operation, have more to do with determining the weight of electrically operated freight trains. Consequently, an electric freight locomotive can usually haul much heavier trains than the steam freight locomotive over the undulating grades usual on most steam railroads.

On some engine districts the weight of freight trains is governed by the starting grades. Here also the electric freight locomotive has the advantage, as all or nearly all the weight is on the drive wheels and the starting capacity of any locomotive is usually proportional to the weight on the drivers.

For passenger service, the higher tractive effort at starting gives the electric locomotive a great advantage, as a higher rate of acceleration can be obtained. Also for local passenger service the higher starting power makes it possible to maintain by electric operation a much higher schedule speed with frequent stops to collect the passengers than could be done with the steam locomotive.

Competition for Different Classes of Railroad Service

The railroad traffic may be divided into six general classes:

1. Suburban passenger traffic.
2. Local or interurban passenger traffic.
3. Through passenger traffic.
4. Local or way freight traffic.
5. Through or drag freight traffic.
6. Manifest or time freight traffic.

The construction of electric trolley lines parallel to steam railroads in many parts of the country, and the operation of electric motor cars at frequent intervals, diverted nearly all of the first and second classes of traffic from the paralleling steam roads. As the trolley cars can accelerate quicker than the steam trains, they can consequently maintain the same schedule speed and still make numerous stops for collecting passengers. The cost of operating the trolley lines range from 12 to about 22 cents per car mile for the one motor car trains, while it takes from 50 cents to $1.40 per train mile for steam operation. Consequently, the interurban electric lines can not only maintain a better service than the steam roads, but also they can afford to charge less fare than the steam railroads, and, as a result, they get nearly all the local passenger business and in addition create a new class of traffic. It has been demonstrated many times that an electric line will, on account of the better service it maintains, get a much larger local passenger traffic out of a territory than a steam railroad usually does.

At the present time the electric lines in many places are handling, with considerable success, a good deal of local freight business. The electric lines have not as yet materially affected that part of the revenue of steam roads which is obtained from the through passenger and freight traffic.

The experience with the electric locomotive has demonstrated its reliability. The operating cost data available from electrified steam railroads have made it evident that many steam railroads could now be operated more economically by electric power. However, the comparative economics of steam and electric railroad operation would, of course, have to be studied for each case, and to bring out the relative advantages and disadvantages of steam and electric operation of trunk line railroads a concrete example will now be discussed.

A Typical Installation

The writer then considers at length the requirements of a typical western road taken arbitrarily as 467 miles in length and divided into three engine districts, respectively 167, 160 and 140 miles long. Electric operation is supposed to be at 11,000 volts, single phase, 15 cycles with 110,000 volts, 15 cycles, high tension lines supplying power to fourteen substations. The local passenger trains are calculated to consist of two electric motor cars and one trailer. The through trains are to be hauled by 100-ton electric locomotives. The local freight trains are to be hauled by an 85-ton locomotive and the through freight trains by 110-ton locomotives.

The paper deals at length with the number of freight trains required, the number of locomotives, etc., and gives interesting tables in this connection. Probably the most valuable figures however are contained in the estimate of the money needed to electrify the 467 miles of steam road considered. This estimated cost of electrification follows:—

Estimated Cost of Electrification

High tension lines (steel tower) 450 miles		$2,250,000
Trolley and feeder wire:		
3/0 grooved copper trolley, 468 mi. at $650 ...	304,200	
Steel trolley wire, 156 mi., at $320	49,920	
2/0 feeder wire, 468 mi., at $500	234,000	
		588,120
Overhead construction:		
Bracket arm construction, 420 mi. at $1650	693,000	
Span construction, 92 mi. at $2600	239,200	
Steel bridges, 4 mi.	36,000	
Section breaks	6,600	
Additional for curved track, 100 mi. at $300 ...	30,000	
		1,004,800
Track bonding:		
624 mi. at $450		280,800
Substations:		
14 substations, 56,000 kv.a.	$616,000	
3 portable stations, 6000 kv.a. (complete)	96,000	
		712,000
Rolling stock:		
14 motor cars, $18,000	$252,000	
10 passenger locomotives, $45,000	450,000	
43 freight locomotives, $50,000	2,150,000	
11 switching locomotives, $35,000	385,000	
		3,237,000
Changing block signals and telegraph (468 mi.)		561,600
Engineering and supervision, 5 per cent.		431,716
Contingencies, etc., 10 per cent.		905,964
Total		$9,972,000
Credit for steam equipment:		
140 locomotives	$2,520,000	
241 coal cars	241,000	
14 passenger cars	112,000	
Give credit for, say, about 70 % of new value ..	2,873,000	2,012,000
Net estimate		$7,960,000

Comparative Cost of Maintenance and Operation

The comparative cost of maintenance and operation by steam and electric power are worked out in detail, the summary of which is given in the following table:—

Summary of Operating Costs

	Steam operation	Electric operation
Maintenance of way and structures	$671,540	$572,096
Maintenance of overhead structures and substations	000	95,710
Depreciation of overhead structures and substations	000	144,084
Maintenance of equipment	1,025,879	619,041
Depreciation of equipment	86,190	64,740
Transportation expense	2,064,800	1,381,187
Taxes		31,551
Totals	$3,848,400	$3,908,409
Annual saving effected by substitution of electric power		$940,000

Return on Investment

The estimated cost of the electrification of the 467-mile railroad considered above was $7,960,000.00 The return on this investment on account of the saving in operating expense was estimated at about $940,000.00 per year. The interest earned on the money used for the electrification of this road would thus be 11.8 per cent. If it is necessary to borrow the money for this purpose, and if it can be obtained at 5 per cent. interest, there would remain a profit to the railroad of 6.8 per cent. of the net cost of electrification.

Besides this increase in the railroad's revenue, it will generally be possible by operating a frequent local passenger train service with frequent stops to increase the passenger earnings and add considerable more money to the net revenue of the railroad. There are very few localities where local pasenger trains are now operated which would not at least add $500.00 per year per mile of line to the gross revenue if frequent interurban cars were substituted for the local steam train. This, of course, will depend upon the density of the population, local conditions, etc. However, the increase in passenger revenue may, under the conditions in many localities, amount to several thousand dollars per year per mile of line, and is a very important consideration wherever electric operation is proposed. At the rate of only $500.00 for the 467 mile railroad considered, the increased passenger revenue would amount to $233,500.00 per year, which would add materially to the revenue resulting from electrification.

Conclusions

As stated at the beginning, the great objection to the electrification of steam railroads is the heavy expenditure involved, while the chief reason for considering the electric operation of steam railroads, aside from some special conditions at local points, was to increase the net earnings of the road. It was further stated that the answer to the question of whether the increased net earnings which would result from the electric operation would be great enough to pay interest on the cost of electrification, and besides leave a profit, could only be had by making a careful investigation of each individual road.

The example taken above was not chosen to favor electric operation but was taken to show actual conditions. It will be noted that the quantity of traffic asumed was comparatively small, which of course does not favor electric operation. The data given above, which will be found similar to those on many steam railroads, show that the traffic on many of the trunk railroads now operated by steam locomotives could be more economically handled by electric locomotives. The fact that, electrically operated, the road considered above could handle the same traffic with about 25 per cent. less train mileage and locomotive mileage than when operated by steam, and with 15 per cent. less ton mileage and about half as many locomotives as are needed for steam operation, is certainly deserving of serious consideration.

The overload characteristic which makes it possible for the electric locomotive to haul heavier freight trains over the short heavy grade sections than can be done by steam locomotives was illustrated above, and would indicate that considerable money now expended upon grade reductions of steam railroads would not be warranted if the road were electrically operated.

There has been considerable discussion lately as to the advisability of each railroad company building a power plant of its own, or else purchasing power from a central power company for railroad operation. One advantage of purchasing power is that the load factor of the large power companies' plants is usually high, whereas on most railroads now operating by electric power the load factor of the railroad power plants is generally low and, consequently, cost of generating power in the railroad plants is high. However, on the other hand, the load factor of a long trunk line will probably be high and the advantage of high load factor in a power company's plant will in many cases disappear.

The most important advantage in favor of railroads purchasing power for electric operation is that the heavy investment necessary for electrification would be reduced. It appears to me that the relative advantages of purchasing or generating electric power will have to be determined by local conditions. The competition between various railroads would, of course, be a very important consideration and is probably one of the principal objections to the purchasing of power from central stations. However, if a long time contract could be made with a power company at a low rate, it would have many advantages.

Another important point is suggested in connection with the electrification of steam roads and supplying electric power for same, which should be mentioned before closing this paper. At many points in the country, large steam-electric central stations have been constructed and at the present time the amount of coal hauled from the mines to these central stations has become very large. It is also absolutely necessary that nothing delay the delivery of coal to the central stations, as the business of a whole community could be easily tied up if the electric power supply was cut off. Consequently, if in providing for future power at such points as Chicago and New York, steam-electric plants be constructed at suitable points in the vicinity of the coal mines of Indiana, Illinois and Pennsylvania, and high tension lines be constructed from these new plants to Chicago and New York, the providing of additional railroad facilities for power plant coal hauling would not be necessary. Also, the present steam plants would insure a power supply at the distributing points during the short interruptions which occur on high-tension transmission lines.

The advantage of this arrangement to the railroads would be that if the high-tension lines were constructed upon the right of way of the railroad lines, the railroads could obtain electric power for their sub-stations, when the roads were ultimately electrified, without the heavy expense of constructing high tension lines of their own. The question as to whether the railroads should own the whole or a part of the power companies, is, of course, a matter which will have to be determined by local conditions.

Where water power is plentiful, as is the case in many sections of the West, the advantage of being able to tie in isolated hydroelectric plants located at points where there is only a small market for power to a network of high-tension lines on the railroad rights of way extending to localities where there is a market for power is evident. Also the chief objection to the electrification of steam railroads (the heavy first cost) would be made of lesser importance by this arrangement.

Street Car Ventilation

In the design of a street car ventilating system the question of fresh air intake is most important both as regards the number and size of the openings as well as their location. Experience has demonstrated the fact that best results are obtained with the intake openings located toward the centre of the car body and this is especially true with double truck cars designed for double end operation. A moving car tends to force the air away from the front end while a vacuum effect is produced at the rear. This air movement causes the dust of the street to be drawn away at the front and carried in toward the rear end. Observation has also shown that the dust stirred up by the car tends to rise to the level of the car body toward the rear while the space between the trucks is comparatively free from dust.

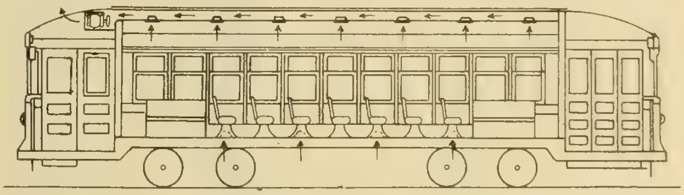


Diagram showing direction of air movement

The Vacuum Car Ventilating Company of Chicago have met the demand for street car ventilation by placing on the market a mechanical system of air removal. A motor-driven exhaust fan is located at one end in the car roof and draws the air from an exhaust chamber built in the car roof and extending the whole length of the car. To provide a fresh air supply a series of openings are made in the floor of the car body immediately below the car heaters, see figure. This provides for the proper temperature of the air. The vitiated air passes upward and enters the exhaust chamber at the top of the car through a series of registers. The exhaust fan creates a partial vacuum in the exhaust chamber in the car roof resulting in a steady upward flow of air from the car body.

The cross section of the area of the openings under the heaters has been carefully considered as well as their location. These are so designed that the temperature rise shall be the greatest possible. The distribution and quantity of air is also such that there is no appreciable draft to cause discomfort to the passengers.

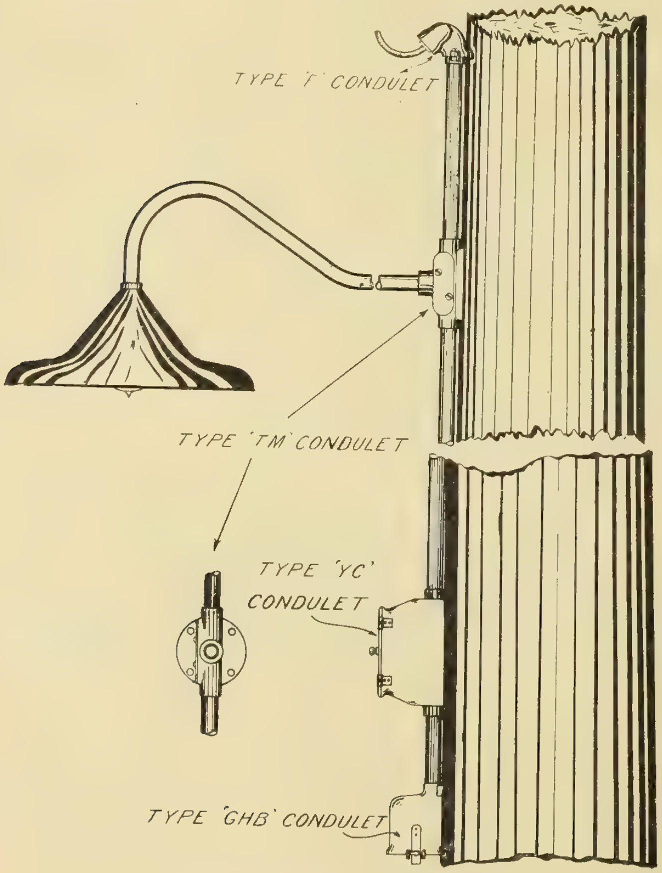
The motor used to drive the fan is designed for 600 volt service, series wound, with steel frame fully enclosed. It requires less than 1 amp. operating at 1950 r.p.m. Under ordinary conditions the motor operates under a load of less than one-half h.p.

The standard equipment manufactured by this company has been designed to provide a circulation of air of from 500 to 600 cubic feet per minute through the car body. If required, larger amounts of air can be moved, but it must be borne in mind that special provision has to be made for heating this extra amount to a comfortable temperature.

Condulet Suggestions for Lighting Railway Yards

The illustration herewith shows a condulet installation used as standard by the Transcontinental Railway Company in their railway yards at Transcona, Manitoba.

A type F condulet is used at the top of the pole for receiving the wires. This is a three-piece fitting composed of a clamping ring, cast iron body and porcelain cover. It provides for the proper separation and installation of the wires. The wires are then extended down through the conduit into a type TM condulet which is a combination of pipe flange and type T condulet, cast in one piece, and is very compact and strong. This fitting is designed to take the various combinations of covers and is generally used, as in this case, for pipe lamp brackets.



A good outdoor wiring installation

The conduit is continued down the pole to the YC condulet, which fitting consists of a one-piece cast iron body, sheet steel hinged cover, and an adjustable cut-out fastening plate. This fitting is designed for main line cut-outs through feed, with enclosed fuses.

At the bottom of the conduit installation on the pole is installed a QHB condulet which is designed for standard thumb knob snap switches to protect the switch and wiring from the weather. The fitting is made weatherproof and is arranged so that the cover of the condulet may be secured by a small padlock and thereby prevent unauthorized persons from tampering with it.

The above installation is in actual use in the Transcontinental Railway yards at Transcona, Manitoba, and from the report we have received from Mr. E. J. Young, electrical engineer for the government, we understand that this installation has proven very satisfactory and that they have adopted the same as their pole lighting standard. The material was supplied and the installation designed and installed by the Crouse-Hinds Company of Canada.

Electric Railway for Ladysmith, V.I.

While on a visit to Vancouver early in May, Capt. Montague Yates, general manager of the Vancouver Island Hydro-Electric and Tramways Company, Limited, announced that all preliminary arrangements have been completed in connection with the construction, by his company, of an electric street railway system at Ladysmith, Vancouver Island, the necessary provincial right having been secured and an agreement with the city endorsed by the ratepayers. It is understood that work is to commence immediately and that an interurban system extending to Chemainus, Duncan, Nanoose and Nanaimo will eventually be put in operation. It may be recalled that this company was unsuccessful last year in an attempt to secure a charter for the construction and operation of a street railway system in the city of Nanaimo.

An Engineering Congress

Announcement is made that in connection with the Panama-Pacific International Exposition which will be held in San Francisco in 1915, there will be an International Engineering Congress in which engineers from all parts of the world will be invited to participate. This engineering congress will be conducted under the auspices of the five following international engineering societies, namely:—American Institute of Mining Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers, American Society of Civil Engineers and the Society of Naval Architects and Marine Engineers. These societies acting in co-operation have appointed a permanent committee of management who will have charge through their various sub-committees of the different departments of the work entailed by a convention of such importance. The scope of the congress has not yet been definitely determined, but it is hoped to make it widely representative of the best engineering practice throughout the world, and it is intended that the papers, discussions and proceedings shall constitute an adequate review of the progress made during the past decade, and an authoritative presentation of the latest developments and most approved practices in the various branches of engineering work. The various committees are now actively at work and more definite announcement can be looked for in the near future.

The Convention of the Canadian Electrical Association is held in Toronto, June 25, 26 and 27

Illumination

Remote Control of Lamps

Electricians are frequently called upon to arrange switches in certain rooms of private residences so that lights in other rooms can be turned on or off by means of them regardless of the switches in the rooms where the lamps are located. Where this is the only condition to be fulfilled the task is an easy one; a three-point local switch and another switch of the same kind at the point of remote control is sufficient. Once in a while,however, it is required that the arrangement be such that certain lights, or all the lights in the house, can be turned on by means of a switch in some particular room, and that they cannot be turned off with any other switch while this switch is kept closed. Sometimes, for example, the owner of the house may want to be able to flood the rooms with light at will by closing a switch in his bed room, and to keep the light on until he opens this switch again. Several schemes for accomplishing this have been worked out, but some of them require an arrangement of circuits which the average electrician is liable to find confusing. The scheme illustrated in the accompanying figure, appears in a current number of the Electrical Review, and is interesting for its simplicity.

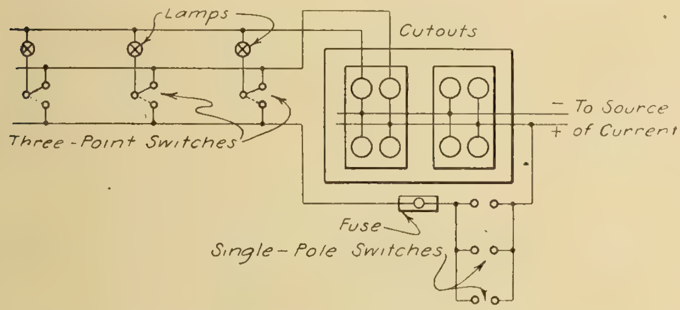


Diagram showing remote control of lamps.

By reference to the figure it will be observed that the lamps in the outlets shown are controlled locally with three-point switches instead of the usual single-pole switches, and one point of each switch connected to a third wire paralleling the two wires of the lamp circuit. Single-pole switches are connected as shown. There may be as many of these as is desired and they may be located in any places convenient. There could easily be one of these single-pole units in each bed room in the house, for example, so that in case of an emergency, such as a burglar invasion, the occupant of any room could immediately light up the whole house. In the figure the single-pole units are shown close together, to save space.

The three-point switches would usually be of a standard type, and each switch would be located in the room where the lamps it controlled were. When the single-pole master switches were all open the lamps could be turned on and off with the three-point switches. But while a master switch is closed all the lamps will keep burning regardless of whether the three-point units be turned so as to complete the circuit along the heavy or along the dotted lines shown connecting the points of the switches.

To keep from confusing the figure but one lamp circuit is shown, but it is a simple matter to adapt the arrangement to a house having any number of circuits. To make the system as complete as possible keyless lamp sockets of such a type that the lamp can be locked in place may be used

New Rules for Low Voltage Work

The new Rules and Regulations just placed in force in Ontario by the Hydro-electric Power Commission with reference to "Low Potential Work," follow. Any circuit which develops a potential below 650 volts is considered as coming under this heading:—

General

a. Wires, when entering cabinets, must be protected by approved bushings, which fit tightly the holes in the box and are well secured in place.

The wires should completely fill the holes in the bushings, so as to keep out dust; tape may be used to build up the wires, if necessary. In concealed knob and tube work, approved flexible tubing will be accepted in lieu of bushings, provided that it extends from the last porcelain support into the cabinet.

b. Wires must not be laid in plaster, cement or similar finish, and must never be fastened with staples.

c. Must not be fished for any great distance, and only in places where an inspector can satisfy himself that the rules have been complied with.

d. Twin wires must never be used except in conduit or where flexible conductors may be necessary.

e. Conductors must, where exposed to mechanical injury, be suitably protected.

When crossing floor timbers in cellars, or any rooms where they might be exposed to injury, the wires must be attached by their insulating supports to the under side of a wooden strip, not less than one-half inch in thickness, and not less than four inches in width. Instead of running boards, guard strips on each side of, and close to, the wires will be accepted. These strips are to be not less than seven-eighths of an inch in thickness, and at least as high as the insulators.

Protection on side walls must extend not less than five feet from the floor, and must consist of substantial boxing, retaining an air space of not less than one inch around the conductors, closed at the top (wires passing through bushed holes), or approved metal conduit or pipe of equivalent strength must be used.

When metal conduit or pipe is used, the insulation of each wire must be reinforced by approved flexible tubing extending from the insulator next below the pipe to the one next above it, unless the conduit be installed according to the rules on conduit wiring and the wire is approved for conduit use. The two or more wires of a circuit, each with its flexible tubing (when required), must be placed within the same metal pipe. Special permission for deviation from this last requirement may be granted in the case of direct-current circuits.

In damp places, wooden boxing may be preferable, because of the precautions which would be necessary to secure proper insulation if metal pipe were used. With this exception, however, metal piping is considered preferable to the wooden boxing; it is especially suitable for the protection of wires near belts, pulleys, etc.

f. Wires, when run in roof spaces, will be considered as concealed, and when run in close proximity to water tanks or pipes, will be considered as exposed to moisture.

Wires in such spaces are considered as exposed to mechanical injury, and must not be run on knobs on the upper edges of joists.

Open Wiring

a. Wires must have an approved rubber, slow-burning weatherproof, or slow burning insulation.

A slow-burning covering, that is, one that will not carry fire, is considered good enough where the wires are entirely in insulating supports. Its main object is to prevent the conductors from coming accidentally into contact with each other or anything else.

Where rubber insulation is used and covered with a flame-proof or other braiding, such braiding, or flame-proofing must be stripped back on all wires or cables, a sufficient amount to give the necessary insulation distances for the voltage of the circuit on which such wires are used. This requirement applies with equal force to joints in wires or cables, or where such conductors are sweated into connectors or lugs.

b. Sub-bases of incombustible, non-absorptive, insulating material, which will separate the wires at least one-half inch from the surface wired over, must be installed under all snap-switches used in exposed knob and cleat work.

Concealed Knob and Tube Work

a. All wires must have an approved rubber insulating covering.

b. Wires must be rigidly supported at a distance of at least one inch from the surface wired over, and must be kept at least five inches apart.

They should preferably be run singly on separate timbers, or studding, and must be separated from contact with walls, floors, timbers, and partitions, through which they may pass by tubes of incombustible, non-absorptive, insulating material, such as glass or porcelain. Wires passing through the cross timbers in plastered partitions must be protected by an additional tube extending at least four inches above the timber.

At distributing centres, outlets or switches, where space is limited, and the five-inch separation cannot be maintained, each wire must be separately encased in a continuous length of approved flexible tubing.

c. When, in a concealed knob and tube system, it is impracticable to place the whole of a circuit on incombustible supports of glass or porcelain, that portion of the circuit which cannot be so supported must be installed with approved metal conduit, or approved armoured cable; except that if the difference of potential between the wires is not over 300 volts and if the wires are not exposed to moisture, they may be fished if separately encased in approved flexible tubing, extending in continuous lengths from porcelain support to porcelain support, from porcelain support to outlet, or from outlet to outlet, and wires must, except where taps are necessary, be in continuous lengths, without joints, throughout.

d. When using either conduit or armoured cable, in combination with concealed knob and tube work, the requirements for either conduit work or armoured cable work, must be complied with, as the case may be.

e. Wires must, at all outlets, except where conduit is used, be protected by approved flexible tubing, extending in continuous lengths from the last porcelain support to at least one inch beyond the outlet.

The proper finishing of wires at outlets is of great importance, more especially when used in conjunction with gas pipes.

From the last insulator to a point below the finish of ceiling, each wire must be separately enclosed in continuous approved flexible tubing, and some suitable method must be adopted to prevent this tubing from becoming detached from the wires. Taping them to the gas pipe is not approved, as it may be necessary to twist or screw out the gas pipe at some time; this might seriously injure the wires, or water might lodge between the tubing and the pipe, and lead to trouble.

The use of two outlet boards set on an angle of 90 degrees is regarded as reliable and satisfactory, and its use is advocated, unless an approved device is used which will effectually clamp the flexible tubing in place.

Where gas is used, the flexible tubing must be long enough to reach below the grounded portion of the insulating joint.

When the surface at any outlet is broken, it must be repaired, so as to leave no holes or open spaces at such outlet.

When it is impracticable to insert the outlet boards described above, as might be the case in knob and tube work installed after plastering or decorating is completed, wooden base blocks, not less than three-fourths of an inch in thickness, securely screwed to lathing, must be provided for switches, and also for fixtures which are not attached to gas pipes or conduit.

It is suggested that approved outlet boxes be installed at all outlets in concealed knob and tube work, the wires to be protected by approved flexible tubing, extending in continuous lengths from the last porcelain support into the box. In such cases the wires must be protected in the manner described above.

Interior Conduit Work

a. No rigid conduit tube having an internal diameter of less than five-eighths of an inch must be used. Measurement must be taken inside the conduit.

b. Must be continuous from outlet to outlet or to junction boxes or cabinets, and the conduit must properly enter, and be secured to, all fittings, and the entire system must be mechanically secured in position.

In the case of service connections and main runs, this involves running each conduit continuously into a main cutout cabinet, or gutter surrounding the panel board, as the case may be.

Where lock nuts are used to secure conduits to outlet or other boxes, there must be one on each side of the wall of the box which will secure the conduit to the box without depending upon the bushing.

c. Except flexible steel conduits of the built-in type, must be first installed as a complete conduit system, without the conductors.

The dimensions of the conduit and the arrangement of the conduit system as a whole must be such that the conductors may be drawn and withdrawn without injury.

d. Must be equipped at every outlet with an approved outlet box or plate.

At exposed ends of conduit (but not at fixture outlets), where wires pass from the conduit system without splice, joint or tap, an approved fitting having separately bushed holes for each conductor is considered the equivalent of a box.

Outlet plates must not be used where it is practicable to install outlet boxes.

The outlet box or plate must be so installed that it will be flush with the finished surface, and, if this surface be broken, it must be repaired so that no gaps or open spaces will show around the edge of the outlet box or plate.

In buildings already constructed, where the conditions are such that neither outlet box nor plate can be installed, these appliances may be omitted by special permission of the Inspection Department having jurisdiction, provided that the conduits ends are bushed and secured.

It is suggested that outlet boxes and fittings having conductive coatings be used in order to ensure better electrical contact at all points throughout the conduit system.

e. Metal conduits, where they enter junction boxes, and at all outlets, etc., must be provided with approved bushings or fastening plates fitted so as to protect wires from abrasion, except when such protection is obtained by the use of approved nipples, properly fitted in boxes or devices.

f. Must have the metal of the conduit permanently and effectually grounded to water piping, gas piping or to a suitable ground plate. If connections be made to gas piping, they must be on the street side of the meter.

If the conduit system consist of several separate sections, the sections must be bonded to each other, and the system grounded; or each section may be separately grounded, as required above.

Where short lengths of conduit (or pipe of equivalent strength) are used for the protection of exposed wiring on side walls, and such conduit, or pipe, and wiring, is installed, as required by Rule "e," "General," "Low Potential Work," the conduit or pipe need not be grounded.

Conduit and gas pipes must be securely fastened in outlet boxes, junction boxes and cabinets, so as to secure good electrical connection.

If conduit, couplings, outlet boxes, junction boxes, cabinets or fittings, having a protective coating of non-conducting material, such as enamel, be used, the coating must be thoroughly removed from threads of both couplings and conduit and also from surfaces of boxes, cabinets and fittings where the conduit or ground clamp is secured in order to obtain the requisite good connection.

g. Pull-in and junction boxes must always be installed in such a manner as to be accessible.

h. All elbows or bends must be so made that the conduit or lining of same will not be injured.

The radius of the curve of the inner edge of any elbow must not be less than three and one-half inches on rigid conduit, nor less than one and one-half inches on flexible conduit or armouring. Conduit must not, for draw in systems, have more than the equivalent of four quarter bends from outlet to outlet.

i. Wires used in conduit must have an approved rubber insulating covering, and must, within the conduit tubing, be without splices or taps.

Attention is here drawn to the fact that insulating rubber covering, for use in unlined conduits, must be double braided.

j. In all sizes larger than No. 12 B. and S. gauge, wires must be stranded.

Exception may be made in straight runs, if without any bends or offsets, where larger solid conductors could evidently be drawn and withdrawn without injury.

k. Conductors must not be drawn in until all mechanical work on a building has been, as far as possible, completed.

Conductors in vertical conduit risers must be supported within the conduit system in accordance with the following table:—

No. 14 to 0 every 100 feet.
No. 00 to 0000 every 80 feet.
No. 0000 to 350,000 c.m. every 60 feet.
350,000 c.m. to 500,000 c.m. every 50 feet.
500,000 c.m. to 750,000 c.m. every 40 feet.
750,000 c.m. every 35 feet.

The following methods of supporting cables are recommended:—

1. A turn of 90 degrees in the conduit system will constitute a satisfactory support.

2. Junction boxes, in which insulating supports of approved type must be installed and secured in a satisfactory manner, may be inserted in the conduit system at the required intervals, so as to withstand the weight of the conductors attached thereto. Such boxes must be provided with proper covers.

3. Cables may be supported, in approved junction boxes, on two or more insulating supports so placed that the conductors will be deflected at an angle of not less than 90° and carried a distance of not less than twice the diameter of the cable from their vertical position. Cables so suspended may be additionally secured to these insulators by tie wires.

Other methods, if used, must be approved by the Inspection Department having jurisdiction.

l. Must have the two or more wires of a circuit drawn in the same conduit.

Special permission may be given to deviate from this rule in the case of direct current conduits if compliance with the rule be impracticable in some particular instance.

m. The same conduit must not contain more than four two-wire, or three three-wire circuits of the same system, except by special permission of the Inspection Department having jurisdiction, and must never contain circuits of different systems.

Moulding Work

a. The use of wood moulding is not permitted.

b. For metal moulding, wires must have an approved rubber insulating covering, and must be in continuous lengths from outlet to outlet, or from fitting to fitting, no joints or taps being made in the moulding.

Where joints or taps are necessary, fittings, approved for the purpose, must be used. Under this rule, wires having a single braiding with a waterproof finish may be employed.

c. Metal mouldings must not be used for circuits carrying more than 1,320 watts.

d. The two or more wires of a circuit must be installed in the same moulding as required for conduit.

e. Must be continuous from outlet to outlet, to junction boxes, or approved fittings designed especially for use with metal mouldings, and must at all outlets be provided with approved terminal fittings which will protect the terminal insulation of conductors from abrasion, unless such protection is afforded by the construction of the boxes or fittings.

f. Where passing through a floor must be carried through an iron pipe extending from the ceiling below to a point five feet above the floor.

This will serve as an additional mechanical protection and exclude moisture often prevalent in such locations.

In residences, office buildings and similar locations, where appearance is an essential feature, and where the mechanical strength of the moulding itself is adequate, this ruling may be modified to require the protecting pipe from the ceiling below to a point at least three inches above the flooring.

g. Backing must be secured in position by screws or bolts, the heads of which must be flush with the metal

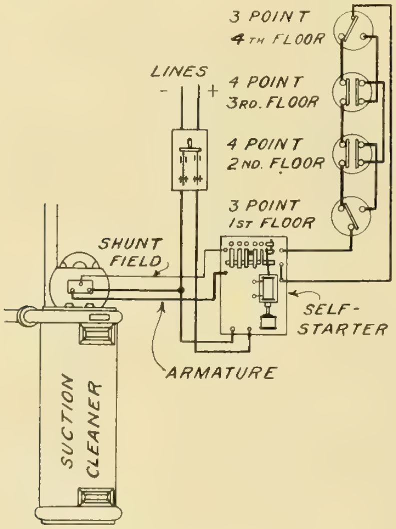
h. Must be grounded and bonded in the same manner as required for conduit.

The general rules under conduit must be observed, that is to say, the metal of the moulding and gas pipes must be securely fastened at outlet boxes, and where metal mouldings, couplings, etc., have protective coatings of non-conducting material, such coatings must be thoroughly removed from the surfaces of boxes, fittings, etc., at the point where a ground clamp is secured, and wherever else it may be necessary to make other good bonds or connections.

The Dealer and Contractor

Control of Stationary Suction Cleaners

The diagram shown herewith indicates how a direct current motor operating a stationary suction cleaner may be controlled from a number of different points through a self-starter. The self-starter is operated by means of an electro-magnet which gains in strength as it cuts out the resistance of the rheostat. In the drawing, control is shown from four points but it will be seen that this could be extended to any number. The upper and lower positions require three point switches and the intermediate positions, four point switches. As shown, the current is on, but it will be seen that a movement of any one of the four switches would open the circuit whereas a further movement of anyone of the switches would again close the circuit. This means that if the motor is not running it can be started by a simple turn of the switch at any one of the four positions, and if the motor is running, it can be stopped by turning the switch at any one of the four points. This arrangement, it will be observed, does not prevent interference from some other floor if the motor has been turned on or off at any particular floor.



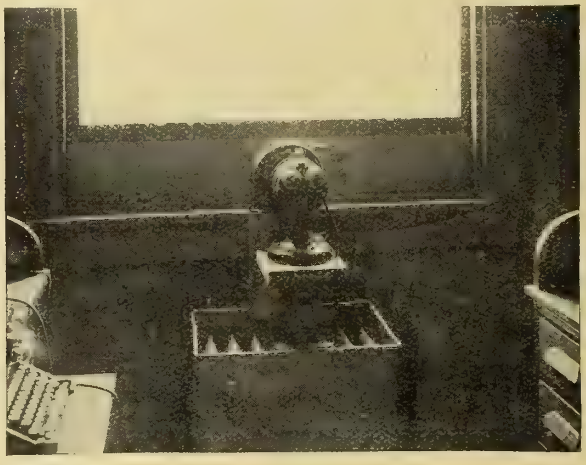
Motor control from any floor

Office Ventilation at Small Expense

Every grown person needs 3,600 cubic feet of fresh air every hour. Without this amount of pure air, we labor under a burden that lowers the vitality and reduces the efficiency for accurate work by an amount proportional to the decrease in the air supply.

Take the case of an office 14 x 20 feet and 11 feet high, which contains about 3,080 cubic feet of air. To supply each of four occupants with 3,600 cubic feet of fresh air per hour, the air must be completely renewed about six times per hour or a little oftener than once every ten minutes. It is evident that it would take a pretty stiff draft blowing through a 5 ft. window raised 3 inches to secure this ventilation. In the winter, coat collars would be turned up, fur collars put on, and there would be four pairs of cold feet. But ventilation can be secured in a better way. If a small motor-driven blower is arranged with piping so that fresh air is drawn from the outside and delivered against a steam radiator, the air will be warmed and delivered in a gentle current which will not cause any discomfort and yet the room will be warm and the air fresh.

Such an arrangement is shown in the illustration, where a Westinghouse general utility motor driving a Sirocco blower is mounted on a stand directly over a steam radiator. The intake of the blower is piped with a gate between it and the board set in the window to give access to the outside air; the outlet delivers the air at the top of the radiator. The air is prevented from blowing along the floor by a galvanized iron box which surrounds the radiator on all sides, extending from the floor to the top of the radiator, but open at the top. Thus the cold air is delivered at the top of the radiator in a downward current, and before it can find its way out of the box again, it must rise around the radiator and become warmed. The blower shown is capable of supplying 175 cubic feet of air per minute, or 10,500 cubic feet per hour, a sufficient supply for three persons. The natural ventilation provided through the opening of doors, around the edges of the windows, and in other ways is sufficient for an additional person. The action of the blower will also tend to stimulate the action of the radiator; the cold air cools the radiator, condenses the steam and causes a fresh supply to enter, thus increasing the circulation of steam and causing the radiator to give out more heat.



Proper office ventilation by motor control

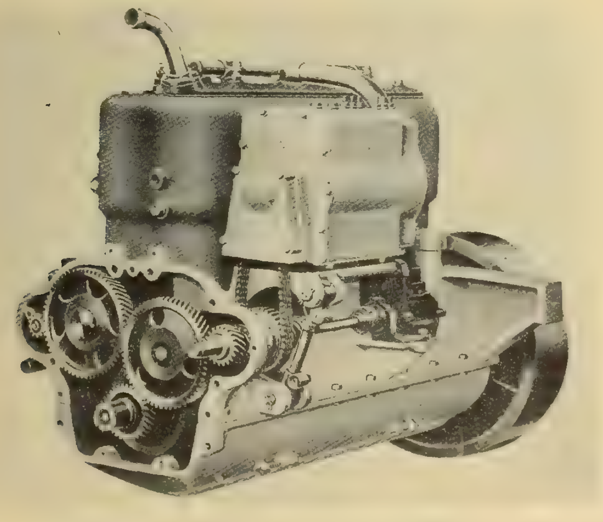
Automobile Starting and Lighting

One of the most difficult questions confronting automobile manufacturers to-day is the selection of a simple and dependable system for starting and lighting. The electric starting system has now become so generally used that it may be considered as standard so that the problem resolves itself into the selection of the best of several systems available.

The illustration shown herewith refers to the "Entz" system, which has been recently placed on the Canadian market by the Adams-Bagnall Company, through Mr. R. E. T. Pringle. The motor is shown in Fig. 1 in the front of the figure and close to one side of the cylinders of the engine. It will be seen that the power from this motor is transmitted to the magneto shaft by a silent chain and thence through timing gears to the crank shaft which it spins swiftly and continuously until the engine is started. The principle on which the system operates is not greatly different from the general system of electric start. The motor is so constructed that it can operate as a generator when occasion requires. Both functions of starting and lighting are performed by this unit. When used as a generator it produces current for charging a storage battery and for lighting the car. When used as a motor it is being driven by the storage battery and is used to start the engine.

The storage battery consists of nine cells of two volts each. This battery floats on the line in such a manner that the motor changes to a generator and back again to a motor according as the voltage rises above or falls below that of the battery. After the engine is started and reaches a certain speed, the voltage of the motor becomes greater than that of the battery, at which point the motor becomes a generator and the battery is charged at all higher speeds at a definite governed rate. The control of the generator output is accomplished through the character of its design without the assistance of any automatic devices.

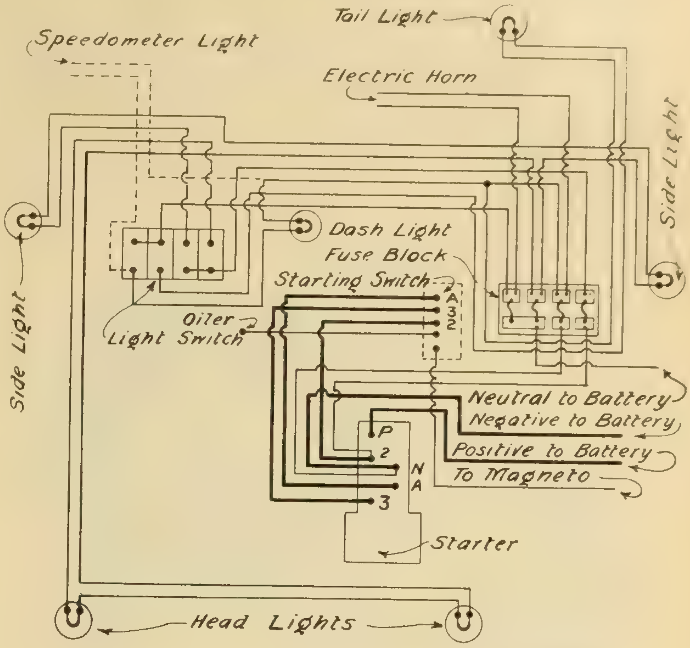
One switch centrals the starter, but there are three switch positions—the "off." "on" and "neutral." In the "off" position the starter is disconnected and the magneto is short circuited so that neither the starter nor the ignition system are in operating condition. When it is required to At this moment the motor begins to operate and the magneto short circuit is broken. As soon as the motor speeds up the engine starts firing and runs under its own power. In the "neutral" position the magneto short circuit is still broken but the starter is disconnected. This position is used on long tours or at abnormally high speeds over a considerable distance. When at the "neutral" the generator stops charging the battery.



Showing self-starting motor attached to engine

The same battery is used for both starting and lighting, but the two circuits are independent. When the starter first operates, the engine is turned over from 100 to 150 times per minute. The starter will even propel the car for a considerable distance.

Fig. 2 represents the wiring diagram for this system of car starting and lighting. All the cells are charged in series and discharged through the motor in series. The two head lights are seven-volt type which are also connected in series and draw current from the first six cells. The side lights are similarly connected. The tail and auxiliary lights are connected across the last three cells, using six volts.



Wiring diagram of lighting and self-starting equipment

The dimensions of the motor are approximately as follows:—Length over all, 13¾ in.; width, 6⅞ in.; height, 9¾ in; weight, 85 lbs. The generator is geared to run at 2½ to 3 times the crank shaft speed.

Large Steam Plant

Contracts for a steam plant of 60,000 kw. capacity have been placed recently in New York by Messrs. Guggenheimer and Company, New York, for the Chile Exploration Company. The equipment at present comprises four 10,000 kw. Siemens generators coupled direct to four 14,300 P.S. Zoelly Steam Turbines of Escher Wyss & Company, Zurich, manufacture. These units will run at 1500 r.p.m. when working with steam of 170 lbs. pressure and 325° Centigrade superheat. Escher, Wyss & Company, Montreal, who are attending to the American business of their works, Zurich, have secured this order against competition from the foremost American and European makers, on the strength of the low steam consumption of their turbine. The plant is to be installed in Chile and the power used for electric smelting of copper ore. The transmission line, which is of 200 miles in length, will be for 110,000 volts pressure. Messrs. Siemens Schuckert Werke have been awarded the contract for the whole of the electrical equipment.

* * *

The Federal House of Commons have given a third reading to the bill of the Quebec Rapid Transit Railway Company. The company is authorized to construct and operate electric lines running from Quebec City in an easterly direction through Limolou and Beauport, thence northerly through Charlesbourg, Riviere Jaune, Lake St. Charles and Indian Lorette, also taking in Ste. Foy, Cape Rouge and Montcalmville. Another line will run from St. Gregoire to Ste.-Anne de Beaupre, crossing from thence the St. Lawrence to the Island of Orleans and circling the Island. The company is also empowered to construct a bridge from the North Shore to the Island. The capital stock is one million dollars.

Weston Miniature Direct Current Instruments

A light compact and portable instrument for the measurement of current or e.m.f. is today recognized as a necessity. It is not, however, an easy task to design and construct an instrument of this type so that it will be accurate, durable and reliable. The Weston Electrical Instrument Company, after making many models, and expending a large sum of money in designing special tools, fixtures and devices, have developed a line of miniature instruments of the permanent magnet movable coil type for the measurement of current and voltage.

A special effort has been made by the manufacturers to enable them to offer a complete line in both portable and switchboard types. They are now able to furnish voltmeters, ammeters, volt-ammeters, special battery testing voltmeters, and milli-ampere meters. Single, double and triple range instruments may be obtained, in various combinations. Dull black Japan with nickel trimmings is the standard finish. These instruments are carefully made, and are very compact. They weigh less than a pound and may easily be carried in the pocket. The pointer of the portable form is knife-edged to permit close reading. The scale length is 2¾ in.

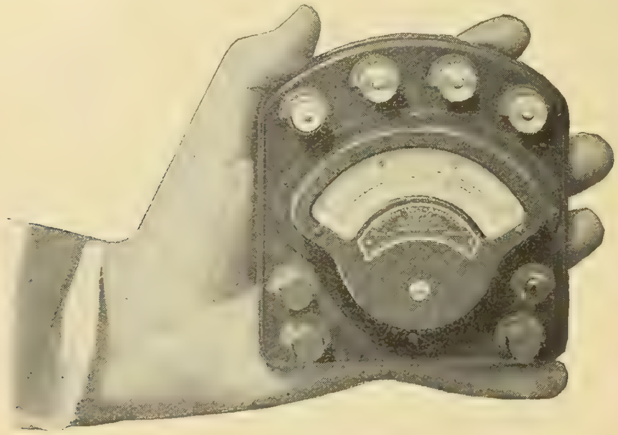


Fig. 1—Volt-ammeter

The movable system of these instruments is extremely light, weighing less than 0.2 gram (less than the weight of two common pins). This system is magnetically damped, and comes to rest quickly after the application of current. In fact not more than about 1/5 second will elapse before the pointer comes to rest in any new position due to changes in current or e.m.f. Both portable and switchboard types are shielded against external magnetic fields and are practically unaffected by changes in temperature.

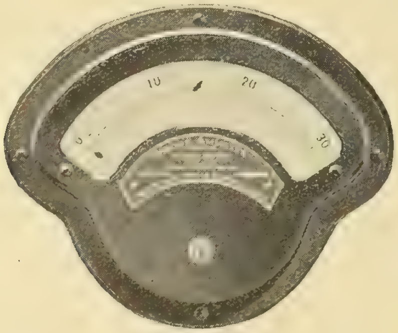


Fig. 2—Volt meter or Ammeter

Fig. 1 shows a triple range portable volt-ammeter which is just one-half actual size, the outside dimensions actually being 4.4 by 4.6 inches. With this instrument any e.m.f. from 150 volts to 0.02 volts, and any current from 30 amperes to 0.05 ampere may be measured. These miniature instruments serve many useful purposes. In high schools and colleges the results obtainable with them are more than equal to class room and laboratory requirements, and their low price permits their extensive introduction, so that each student working in a laboratory may be provided with an instrument. Experimenters and amateur electricians working in wireless and other lines, will find that one of these instruments will meet their requirements, and the accurate quantitative results obtained will encourage the user to attempt more difficult work. Wire chiefs in telephone and telegraph work, railway engineers and many others who must carry instruments, to perform general testing or inspecting, will appreciate the light weight and compactness of these instruments.

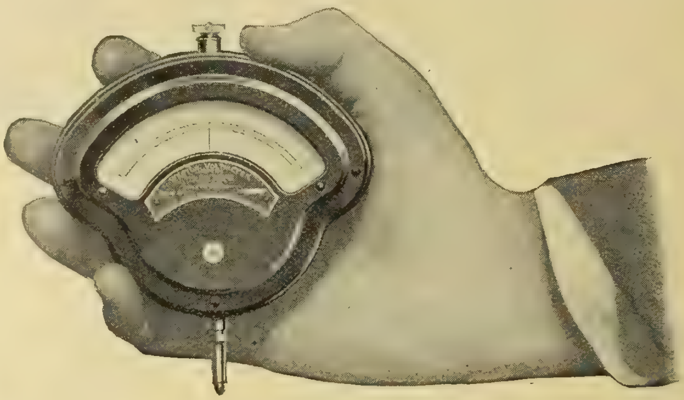


Fig. 3—Battery Testing Volt meter

The miniature switchboard meter shown on Fig. 2 is also one-half actual size. The movements in these instruments are practically identical with the portable models, but a pointer with a pair-shaped tip is used to permit readings at a considerable distance. These instruments are all single range and back connected. They are made in numerous ranges from 50 milli-amperes to 30 amperes, and from 50 milli-volts to 150 volts. These instruments are especially useful in all cases where small size and weight are important factors, and with the advantage of low first cost, serve excellently in connection with automobile self-starters or head-light batteries, small isolated plants, apparatus for physicians use in electro-therapeutics, dental work, etc.

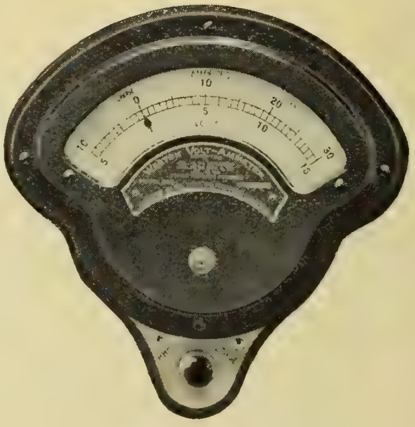


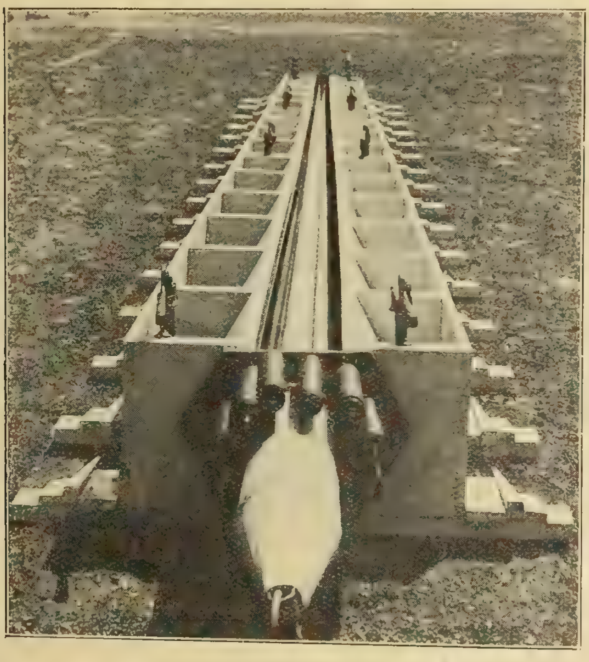
Fig. 4—Volt-ammeter

Fig. 3 represents a battery testing voltmeter, one-half actual size. These are provided with a steel point at one terminal which is removable and may be replaced by a regular binding post nut. To the other binding past may be attached a flexible cord with another point supplied with the instrument. The pointer is of the knife-edge type and the scale is preferably figured with zero in center so that the voltage of any coil may be determined without reversing connections.

Fig. 4 illustrates a switchboard volt-ammeter, designed specially for storage battery charging outfits, for automobiles and other small installations where it is necessary or preferable to use one instrument to indicate both volts and amperes. Normally it indicates the charging or discharging current but when pressure is applied to the contact button the pointer will indicate volts.

Hollow Concrete Poles

The National Reinforced Concrete Corporation have issued an interesting booklet describing the manufacture of reinforced hollow concrete poles. The illustration herewith shows the form with the core in place ready to run in the concrete. The reinforcing rods are shown with plate and long cylinder washers with stretcher bolts on both ends on the rods in place and for stretching these rods. The core shown is started when the concrete has set sufficiently that it is just possible to make an impression with the finger and is removed about 6 in. to free from binding, after which it is left for several hours and then removed. After forty-eight hours, or long enough for the concrete to become hard enough to hold the tension of the reinforcing bars, the stretchers are released and the sides of the form taken from the pole. The pole is removed from the base after four or five days. The following remarks of this firm regarding concrete poles, are of interest.



Form for moulding concrete poles

The ever-increasing demand for electric light and power, and the wide development of electric traction, as well as the wonderful increase in telegraph, telephone and signal service, has caused engineers to look for a suitable substitute for wooden poles, which have proven unsatisfactory on account of their short life, due to the action of the elements. Wood preservatives to delay decay have been used, but on account of the expense of treating the entire pole, the cost exceeds the benefit of additional life attained.

Steel poles and towers have therefore come into general use for power transmission lines, but these require frequent painting and are not only expensive as to first cost, but require considerable attention to prevent corrosion.

Properly designed reinforced concrete poles can be made to attain the necessary strength, and as in the case of steel poles, they can be set at greater distance apart than wooden poles. The fire resisting qualities of concrete is equal to, or greater, than that of steel. Reinforced concrete poles can be readily modified in outline and have a pleasing appearance, due to the natural gray of the concrete, which can be given any other color if necessary, and ornamented as desired. The hollow passage in the interior of the poles may be used to carry wires to the ground, and thence in any direction to the basements of buildings or to conduit systems.

Many engineers have doubted that such a long, slender structure would be able to withstand severe strains without cracking. Properly designed poles do not crack, and moisture is excluded by means of a proper concrete filler used on all poles exposed to frost or damp. The handling of these poles has been carefully worked out, and poles up to 35 and 45 feet long have been loaded, handled and unloaded in the same manner as wooden poles.

In places difficult of access, we claim that our pole is superior to all others, as our system of moulds lends itself readily to the manufacture of the pole immediately adjacent to the place of erection. It is much cheaper to haul the materials and make the pole on the ground, than to haul the pole itself, except possibly by railroad companies. In many instances the above method of construction will enable the engineer to use reinforced concrete poles at lower cost than steel or wood.

The cost of taking up slack in lines supported by wooden poles, which sway about in heavy wind and loosen the wires, requiring frequent readjustments; also the cost of restringing wires every ten years when wooden poles decay and have to be removed, has proven a great expense. Concrete poles do not sway in the wind on account of their great weight and the wires remain free from slack for a greater time. The appearance of the concrete pole does not change with age, requires no painting and will not burn.

Reco "One-day" Time Clock

The Reynolds Electric Flasher Manufacturing Company of Chicago and New York are now placing on the market a neat, compact, inclosed-in-iron-cabinet, one-day Time Clock. The size is 10 in. x 4½ in. x 5 in. and the clock may be installed in any convenient place inside or out of doors, as the case is weather-proof. The clock is of standard make, especially designed for this work and requires no other attention than daily winding. The switch mechanism is mounted on a porcelain block and the tripping arrangement is simple, yet effective and thoroughly reliable. The cabinet has a door at the back, which permits easy access to all of the winding levers, switch set, wiring, etc. The switch was designed after much fore-thought and a close study of conditions, with a decision to make a strong, practical and simple device, selling at a reasonable price. This switch is suitable for turning off electric signs, show-window lights, store or hall lights, apartment house lights, isolated street lights, patrol alarm systems, etc.

One-day type time clock

The Utilities Committee of Kingston will ask the Hydro-electric Power Commission of Ontario to submit estimates on the cost of an interurban electric railway between this city and Cornwall.

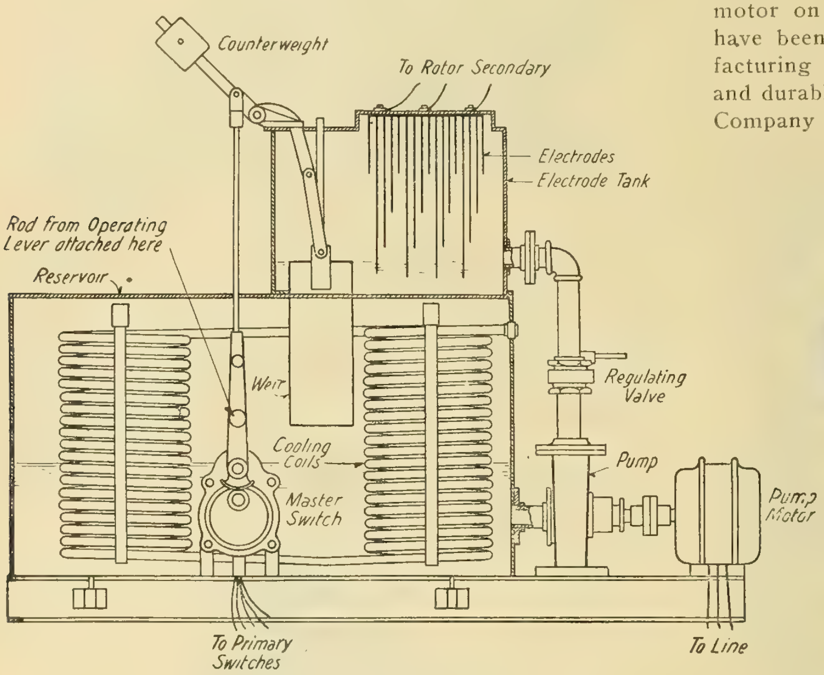
Liquid Rheostats for Large A.C. Motors

The use of large alternating-current slip-ring motors for driving mine hoists, winding gears and rolling mills, etc., has increased largely during the past few years and has created a demand for a simple, efficient and economical controller. To meet this demand the Westinghouse liquid rheostat has been developed.

These rheostats provide an infinite number of steps between the minimum and maximum limits, thus permitting fine speed adjustments and very smooth acceleration. The rate of acceleration can be definitely fixed and in independent of the rate at which the operator manipulates the starting lever; it is then impossible to injure the motor or the machine it drives by too rapid acceleration.

The entire apparatus is very simple in construction and very reliable in operation. There are but very few parts susceptible to wear or deterioration and these can be easily and cheaply renewed.

The principle of operation of these rheostats is clearly shown by the accompanying diagram. The rheostats consist of two compartments, an upper tank for the electrodes, and a lower reservoir. The three phases of the rotor are connected to the electrodes suspended in the upper tank. A small motor-driven pump pumps a steady stream of liquid, usually a solution of soda, from the reservoir into the electrode tank, and back into the reservoir over a weir. Now by raising or lowering the weir, the height of the liquid in the electrode tank is correspondingly varied. The resistance in the rotor circuit decreases as the liquid level rises, and vice versa, and the motor speed, of course, changes with the rotor resistance.



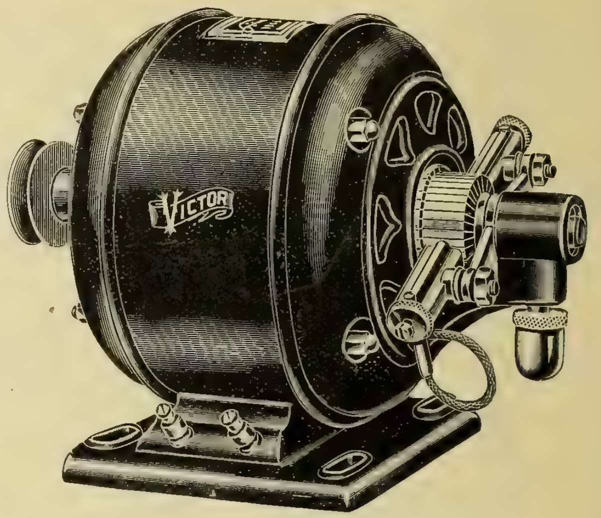
Diagrammatic sketch of liquid rheostat

The primary circuit of the motor is opened and closed by means of electrically-operated switches, which are controlled by a master switch mounted on the rheostat. The operating lever on the rheostat controls both the master switch and the weir. When the lever is in its central, or off, position, the primary switches are open and the weir at its lowest level, so that the secondary resistance in maximum. Moving the lever in one direction closes the proper primary switches for starting the motor forward and raises the weir. Moving the lever in the opposite direction, reverses the motor and again raises the weir. Speed control is secured by varying the position of the weir by moving the lever; the primary switches do not open until the lever is placed in the off position.

A valve in the intake pipe of the electrode tank regulates the rate at which the liquid is pumped in, so that no matter how quickly the operating lever is moved, the liquid can only rise at the rate for which the valve is adjusted, thus fixing the rate of acceleration. When the lever is returned to the off position, the weir drops and the liquid level promptly falls. Cooling coils in the reservoir prevent rapid evaporation of the liquid. These rheostats are made in capacities of from 400 to 1,500 horse power.

Series Type A.C. Motors

Many users and manufacturers of small motor driven apparatus require a variable speed so as to obtain a maximum of efficiency from their machines which has resulted in a constantly increasing demand for small series type motors for operation on a.c. circuits. This variation of speed is obtained by two methods—mechanical control and electrical control. A mechanical control is not so efficient and in certain kinds of apparatus is impracticable. On the other hand electrical control can only be obtained from a series type motor on alternating current, comparatively few of which have been placed on the market on account of the manufacturing difficulties in turning out a thoroughly reliable and durable machine. In this connection the Victor Electric Company have recently brought out a series type a.c. motor, for which they claim that the previous objections have been overcome. They call attention to the practically sparkless commutation of their motor which they say is so perfect that it can be favorably compared with the commutation of direct current motors.



Victor variable speed motor

The motors are built in two sizes—1/8 and 1/6 h.p., and are designed for operation at 110 or 220 volts at 25, 30, 40 and 60 cycles. Both these motors are built in the same frame which is approximately 6½ in. x 7 in. x 9¾ in. in size. The field and the armature cores are built up of very thin and specially annealed Swedish iron laminations. The commutator is made of a special copper composition which is tougher and is claimed to wear better than pure carbon. The brushes are moderately wide and flat and are of the highest grade of imported carbon. The motors are finished in black Japan and nickel and are made either semi-enclosed or entirely enclosed.

These motors are specially adapted for the operation of apparatus requiring full torque such as washing machines, vacuum cleaners, or any other device likely to be overloaded for short periods. There are no starting devices. The speed can be controlled with a separate rheostat similar to that used on direct current motors which does away with the objectionable features encountered where the brushes are shifted. It also gives a maximum of power on the various speeds.

Expansion Chamber of Siemens Oil-Cooled Transformers

It is essential for the reliability of oil-cooled transformers that the oil remain unaltered as long as possible, because one of the chief causes of trouble has been due, until a quite recent date, to the deterioration of the oil through chemical change and formation of sludge. This trouble, which used to start after comparatively few hours of running, has been more and more reduced by careful selection of the oil, assisted by long experience. It was found impossible, however, to avoid this trouble altogether, and impurities in the oil always began to show themselves at some time or other. Further experiments demonstrated the fact that warm oil, if in immediate contact with air, absorbs oxygen from the atmosphere and begins to undergo a chemical change.

As a result of exhaustive tests the Siemens Companies have re-designed their medium and large transformers in order to prevent the heated oil from coming in contact with the air. This is accomplished by providing a second tank (the so-called expansion chamber) which is connected with the transformer tank by a siphon-pipe. The whole is then filled with oil to such a level that the siphon-pipe is filled with oil, even when the transformer is cold. On account of the siphon-pipe, no circulation of the oil between the transformer tank and the expansion chamber can take place (disregarding for the moment expansion of the oil) so that the oil in the latter remains cold and keeps the hot oil from exposure to the air. The cold oil of the expansion chamber (provided it is a mineral oil) remains practically unaffected by contact with the atmosphere. As the transformer temperature rises, a certain amount of warm oil will expand from the transformer tank past the bend of the siphon-pipe into the expansion chamber, but since this flow only takes place gradually, the heated oil from the transformer is either already comparatively cool when it reaches the expansion chamber, or else cools down quickly after it has entered. The expansion chamber, therefore, only contains oil at low temperature, which remains practically unaffected by exposure to the air. The expansion chamber, in addition to preserving the oil, offers the further advantage of preventing water from condensing on the cover of the transformer.

In the ordinary design, without expansion chamber, the alternate expansion and contraction of the oil causes air to be sucked into, and expelled from, the transformer case. The air, of course, is laden with a certain amount of moisture which condenses on the cover when the transformer cools down suddenly. The new arrangement excludes completely the formation of water inside the casing through condensation. The outlet of the siphon-pipe in the expansion chamber is arranged in such a position that any water which may collect in the expansion chamber cannot enter into the siphon-pipe before the water level in the expansion chamber has reached a certain height. A drain-off screw is provided in the bottom of the expansion chamber by means of which the lower strata of the oil can easily be checked from time to time, so that any accumulation of water can be detected in good time and removed.

"The First Engineers"

The Canadian Allis-Chalmers have issued an unusually attractive calendar, the picture portion showing a colony of beavers at their work and entitled "The First Engineers." This is the emblem uniformly adopted by this company but the present calendar adds "Our Old Friends in a New Light," referring to the fact that the Allis-Chalmers-Bullock Limited have been reorganized under the name of the Canadian Allis-Chalmers, but will continue to carry on the same line of manufacturing.

Trade Publications

Bruce, Peebles & Company—This company have just issued specifications sheet No. 59, dealing with their standard turbo-alternators, in which full information is given with regard to winding insulation, brush gear, ventilation, etc. On the front page of this specification is given an illustration of their enclosed type of machine which is the standard arrangement for all the turbo-alternators of this company with the exception of the two smallest sizes which are of the open type.

Automatic Trolley Guard—A pamphlet issued by the Electric Service Supplies Company, describing a safety contrivance of use principally where overhead trolley lines run across steam railroads at grade. This guard prevents accidents by keeping the trolley wheel on the wire while the car is passing through these danger zones.

Pneumatic Tools—Bulletin No. 34-L of the Chicago Pneumatic Tool Company's Compressor Department. This bulletin is one of the series covering the company's complete compressor line, and treats particularly of general engineering information of value to users of compressed air. It contains tables giving efficiencies of air compression at different altitudes, density of gases and vapors, mean effective pressures and horse powers, loss of pressure due to friction in pipes, and many others, some rare and all important. Also information for intending purchasers, showing the data required for intelligent estimates. Views of various types of compressors are shown in miniature.

New Books

A Laboratory Manual of Alternating Currents—By John H. Morecroft, E.E.; Longmans, Green & Company, publishers. Distributed in Canada and Newfoundland by the Renouf Publishing Company, 25 McGill College avenue, Montreal. Price $2.25. Mr. Morecroft's method of handling the subject matter to be investigated by experiment consists in a careful analysis of the test to be performed, of the different variables involved, their relations to one another, errors likely to be introduced, etc. The idea is that the student should, as far as possible, be made to work out for himself the scheme of connections, meters to be used, readings to be taken, arrangement of data on the record sheet, etc. This is deemed the proper course inasmuch as it is the one that must be followed by the practising engineer who is carrying out any commercial test. The analysis of the action of alternating current meters has been given in more than usual detail and a method for predicting the regulation of an alternator is given in which all the factors entering into the question are logically treated. The experiments described are designed for the use of senior students in electrical engineering and are supposed to parallel and reinforce the lecture course being taken at the same time. The manual is well printed and freely illustrated.

The University of Toronto have awarded the following professional degrees to well-known Canadian engineers:—F. A. Dallyn, the degree of civil engineer (C.E.); E. A. James, the degree of civil engineer (C.E.); C. H. Marrs, the degree of civil engineer (C.E.); D. L. H. Forbes, the degree of mining engineer (M.E.); A. G. Christie, the degree of mechanical engineer (M.E.); E. H. Darling, the degree of mechanical engineer (M.E.); G. J. Manson, the degree of mechanical engineer (M.E.); R. S. Smart, the degree of mechanical engineer (M.E.); P. H. Mitchell, the degree of electrical engineer (E.E.).

Current News and Notes

Brandon, Man.

The first three of the new cars to be operated on the municipal railway lines arrived in Brandon on May 7.

The first car was tried out on May 17, but a regular service will not be inaugurated until about the first of June.

Battleford, Sask.

The Battleford municipal electric light plant are at present installing two 240 h.p. oil engines which will drive two 200-kv.a. generators. The plant is in charge of Mr. F. K. Martin.

Berlin, Ont.

A by-law was carried on May 16, authorizing the double-tracking of the railway system from Wellington street to the Waterloo boundary line. The by-law provides for an expenditure of $30,000.

Brockville, Ont.

The Light & Power Department of Brockville, Ont., are calling for tenders for a cluster light installation along both sides of Main street for a distance of one mile.

Barrie, Ont.

It has been decided to install single tungsten lamp units supported from posts already on the streets, in preference to cluster lights on ornamental standards. This is for the main streets where the arc lights are now in use. It is probable the arcs will be removed to the outlying districts. Mr. J. B. Dougall, chairman of the Water & Light Commission, will have the matter in charge.

Cobourg, Ont.

During the month a number of prominent farmers have been supplied with power and light by the Seymour Power Company.

Caledonia, Ont.

The Grand Trunk Railway Company contemplate the installation of electric lights throughout their station, sheds and yards.

Edmonton, Alta.

Plans have been prepared for about three miles of extension out to the Belmont school. It is the intention to use two Edison-Beach cars.

It has been definitely decided to build about 21 miles of municipal track extensions this summer. The track work has been ordered, as well as 35 single end semi-convertible cars from the Preston Car & Coach Co. The order for rolling stock also includes one dump car to be supplied by the Canada Car & Foundry Company, and a 5,000 gallon sprinkler being purchased in the United States. A new car barn on the north side of the city is almost completed, and it is the intention to erect another on the south side to accommodate 15 or 20 cars and designed for extensions when the requirements of the system demand it.

Fort William, Ont.

A contract has been awarded for poles, spikes, etc., required for street railway extensions, to the United States Steel Products Company of New York.

Galt, Ont.

A petition has been circulated and largely signed by the residents of Ainslie street, Galt, and handed to the Hydro-electric Department requesting that three-light ornamental standards be installed from Colborne street to Concession street on both sides of the roadway.

It has been stated by Mr Thomas Patterson that he has authority from General Manager Coleman of the Dominion Power & Transmission Company, Hamilton, to say that construction will start in the near future on a radial line connecting Hamilton with Galt, by way of Lynden and Troy.

Halifax, N.S.

The bill to extend the franchise of the Halifax Electric Tramway Company by which they would be allowed to develop electric power at Gaspereaux Falls and to increase their capital from $1,500,000 to $10,000,000, has been defeated in the Nova Scotia legislature. At the same time the city bill to provide for a vote on municipal ownership of the tram system was thrown out.

The Halifax Electric Tramway Company have been given authority, by a recent act, to increase their capital by $500,000. This followed the failure of a previous attempt to reorganize on a much larger scale. Even the smaller increase, however, was strongly opposed by the city council who are in favor of municipal operation.

Hull, P.Q.

The Hull Electric Company has been authorized to construct a spur from a point on its main line between Hull and Aylmer to the premises of the Connaught Park Jockey Club.

Hamilton, Ont.

The application of the Hamilton Street Railway Company for permission to make certain extensions on the streets of the city has been approved by the Railway Board.

The local Hydro-electric Department have adopted the policy of selling household appliances, such as electric toasters, irons, etc., and a protest has been raised by dealers in electrical supplies. It is pointed out by the Commission, however, that there is no intention of cutting prices, and that they have gone into this matter with a view solely to increasing the consumption of electric energy.

Kamloops, B.C.

Tenders will be received to June 12 for water wheels, generators, exciters, transformers and switching equipment for the proposed hydro-electric power plant.

Tenders are called to June 12, for transmission line equipment between Kamloops and the new hydro-electric plant on Barriere River.

Revised estimates of the cost of the new power house and equipment according to the latest plans, show that the total will be in the neighborhood of $212,000. A new by-law will be submitted, authorizing the expenditure of $260,000 for this purpose.

Kemptville, Ont.

Light and power is supplied to this town from a water power on the Rideau Canal at Andrewsville, about 14 miles distant. Power is generated at 60 cycles, 3-phase, 10,000 volts. This plant is now being offered for sale.

London, Ont.

The Parker Car Heating Company, who at present manufacture an economical system of heating for steam cars, announce that they will shortly place on the market an equipment specially designed for electric cars.

The annual report of the London Street Railway Company for the year ending December 31, 1912, showed gross earnings of $306,231 and net earnings of $95,952. These are increases of $26,624 and $9,082 over the previous year respectively. The net surplus available for dividends was $67,041, as compared with $58,026 the previous year. The bonded debt of the company is $575,000. The capital stock stands at $552,000.

Morden, Man.

The Morden Electric Light Plant contemplate building one mile of new pole line on Wardrope and Seventh streets this summer. The company is at present building an office and stock room annex to the power house. Mr. T. H. Forster is manager.

Melita, Man.

On May 17 a by-law was voted on in Melita, Man., giving Mr. R. E. Denny franchise for lighting, heating, power and street railway operations.

Kingston, Ont.

Montreal, Que.

On June 5th the Sons of Jove will hold a rejuvenation at Cooper's Restaurant, Montreal.

Tenders will be received by the Board of Waterworks Commissioners for a 1,000,000 gallon electrically operated pump for the Waterworks Department.

In anticipation of the winter load, the Montreal Light, Heat & Power Company have decided to install two additional 3-phase 13,200 volt cables from Cote St. Paul to the Central Station. The cables will be supplied and installed by the Canadian British Insulated Company, Limited, Montreal.

Mr. W. J. Camp, assistant manager of the C. P. R. telegraph department, Montreal, attended the annual meeting of the association of Railway Telegraph Superintendents at St. Louis, Mo.

Mr. James Bennett, late chief inspector of the Canadian Fire Underwriters' Electrical Department, has resigned his membership of the electrical committee of the National Fire Protection Association, Boston.

May 31st is the date set for opening the first portion of the line which the Montreal and Southern Counties Railway are constructing to Granby, P.Q. This section is from St. Lambert, through Greenfield Park, St. Hubert, Brookline, Chambly Basin to Chambly Canton. A number of new cars are to be put on to this extension of the company's service.

The city of Westmount, P.Q., have awarded a contract for the supply and installation of a large quantity of high tension twin conductor arc lighting cable to the Canadian British Insulated Company, Limited, Montreal. This company will also supply a quantity of low tension twin conductor double steel tape armoured cable to Westmount.

Mr. Lawford Grant, president and managing director of the Canadian British Insulated Company, Limited, Montreal, has resigned his post as managing director to take up an important position with the Eugene F. Phillips Electrical Works, Limited, Montreal. Mr. Grant will, in all probability, retain the presidency of the Canadian British Insulated Co.

The British Columbia Electric Railway Company have awarded a contract to the Canadian British Insulated Company, Limited, Montreal, for 12,500 v. three-phase paper insulated lead covered double steel tape armoured cable. This cable will be laid direct in the ground without any protection—a practice which is common in Europe, and is gaining favor in Canada.

One of the Siemens European companies is supplying two 3-phase transformers each 23,500 kv.a. capacity stepping up to 25,000 volts to the Westphalian Electric Works. These transformers will be used in conjunction with 15,000 kw. turbo-generators recently supplied by the same company. We believe these transformers are the largest that have ever been constructed.

An order for the supply and installation of a three-phase 12,500 v. submarine cable for crossing the St. Lawrence at Lanoraie, has been placed by the Shawinigan Water & Power Company with the Canadian British Insulated Company, Limited, Montreal. The cable will be No. 2 B & S gauge, paper insulated, lead covered and double steel wire armoured, made up to the specification of Mr. Julian C. Smith, M.I.E.E., chief engineer of the Shawinigan Company.

The Shawinigan Water & Power Company have just published a very handsome booklet describing their property and plant at Shawinigan Falls and Montreal. The generating capacity of this company consists of six turbine units totalling 55,500 h.p. in plant No. 1, which is transmitted chiefly at 50,000 volts. In plant No. 2 only two units are installed to date, each of 16,000 h.p. capacity, but the ultimate capacity of this plant is five units, or 80,000 h.p. It will thus be seen that the total generating capacity at Shawinigan Falls will in the near future be 135,000 h.p. The output from the new station is transmitted at 100,000 volts.

The reorganization of Fred Thomson & Company, manufacturing and contracting electrical engineers, 326, 328 and 330 Craig street west, Montreal, is due to increasing business, and after June 1st the firm will be carried on by a limited liability company under the name of the Fred Thomson Company, Limited. The capital stock is $100,000, divided into 1,000 shares of $100 each. Mr. Fred Thomson, who is known throughout Canada as one of the pioneers in the electrical industry, is the president and general manager; Mr. Clarence Thomson is the vice-president and secretary-treasurer; Mr. H. A. McPhee, superintendent; and Mr. A. Walker, electrical engineer.

The Montreal Council have received eight tenders for enlarging the aqueduct, ranging from over four million dollars to $2,322,560. Under this scheme it is proposed to generate 10,000 horse power, 6,000 of which will be utilized for pumping and 4,000 for lighting the city. The project has been delayed, and this, according to Controller Ainey, will have an important bearing on the present contract with the Light, Heat & Power Company. The Council can cancel this contract at the end of two years from now, but owing to the delay in enlarging the aqueduct, it will be impossible for the work to be done in time to permit the city to inaugurate its own lighting system. The city will thus have to enter upon a second five years' contract with the light company. The city is at present paying $260,000 a year for street lighting with an annual increase of about $20,000.

Mount Forest, Sask.

The Mount Forest Telephone Company will require material for the construction of a telephone system.

Naisberry, Sask.

The Naisberry Telephone Company contemplate the erection of a telephone system, and will require the necessary material. Mr. T. Cochrane is president.

Nelson, B.C.

The finance committee has recommended to the city council that the city guarantee a new issue of Nelson Street Railway Company bonds to the amount of $40,000, with the provision that the system be operated by a board of seven directors, including the chairman of the finance committee and of the fire, water and light committee. It is also suggested that the city should get half the profits, if any, after current expenses have been met.

Ottawa, Ont.

It is reported that construction work will begin on the Ottawa and Morrisburg Electric Railway line not later than the first of June.

Porcupine, Ont.

The Northern Canada Power Company, owning power plants at the Wawatian and Sandy falls, have been experiencing interruptions due to the spring floods in that district.

The plant at Wawatian Falls was the first to be inconvenienced, but it is later reported that the Sandy Falls generators have received considerable damage.

Pleasant Dale, Sask.

The Pleasant Dale Telephone Company are reported to require material for the construction of a new system. Mr. W. R. Wilson is secretary of the company.

Richmond, P.Q.

It is stated that Mr. Jno. R. Hall has sold his power rights on the St. Francis River to the Canada Paper Company, and that the same company have also purchased the rights at Kingsey Falls, also on the St. Francis River. These two falls together are estimated at about 1,500 h.p., continuous capacity. It is said these water sites will be developed and energy transmitted to Windsor Mills to be used there in the factories of the Canadian Paper Company and the Canadian Explosives Limited.

St. Catharines, Ont.

A by-law will be submitted on May 30, confirming an agreement between the Lincoln Electric Light & Power Co., Limited, and the Corporation of the City of St. Catharines, by which the company agrees to light the streets of the city for a term of five years. The type of lamp used is the electric arc of nominal 2,000 candle power, 6.6 amp., 480 watts. At least 100 of these lights shall be used by the city at a rate of $50 per annum. The agreement also contains the proviso that the city may string wires for fire alarms, city telephones or for any other exclusively city purpose on the company's poles.

St. John, N.B.

The St. John Railway Company propose to erect an additional car shed on Wentworth street and to install four additional sidings.

Stratford, Ont.

It is understood that the Bell Telephone Company will have their plans for underground conduit work completed in the near future.

The franchise of the street railway company expires here on June 1. It is understood, however, that the company intend to commence construction operations before that date.

St. John, N.B.

Further evidence has been taken on the objections raised against the construction of a power plant at Meductic Falls by the St. John River Hydro-electric Company. Both fishing and lumbering interests were represented.

Summerland, B.C.

The Summerland municipality at present is supplied with light by a small water wheel of the Pelton type, operating at 30 kw., Canadian Westinghouse, 2-phase, 60 cycle generator. It is proposed either this year or next to increase the capacity by the installation of a 60 kw. generator operated by a Diesel oil engine.

Thornloe, Ont.

The Pioneer Rural Telephone Company has been incorporated with head office at Thornloe in the district of Nipissing.

Tilsonburg, Ont.

The Tilsonburg Electric Car Company, Limited, has been organized to manufacture electric street cars, snow sweepers, sprinklers, etc.

Toronto, Ont.

The Toronto Hydro-electric system called for tenders up to May 22, for vitrified clay conduits.

A committee of five U. S. senators has been appointed to investigate the Niagara Falls power situation in all its phases.

Governor Sulzer, on May 29th, signed the Wagner Bill which repealed a charter granted in 1907 to the Long Sault Development Company, giving power to develop electric energy on the St. Lawrence River. The bill provides that $36,000 be returned to the company for moneys paid out by them.

The Toronto Railway Company have applied for permission to build a car barn on the south side of Queen street nearly opposite Greenwood avenue. The building is to be one storey, brick, with a frontage on Queen street of 100 feet, and with a depth of 360 feet.

The St. Clair Avenue line which is being constructed and will be operated by the municipality, will probably be ready by about the 1st of July.

The Volt Electric Company, Limited, has been incorporated with a capital of $40,000, to manufacture and deal in electrical appliances, devices, etc., with head office at Toronto.

It is stated that the Toronto Hydro-electric Commission will proceed at once with the installation of lights in Todmorden, Dawes Road, Swansea and Runnymede.

The Metropolitan division of the Toronto & York Radial Railway Company's system was opened for Sunday traffic on May 18. The heavy traffic indicated the great need of this service.

The first draft of the proposed agreement between the township of York and the Forest Hill Electric Railway Company has been submitted to council for approval. The company must spend $50,000 during the present year.

According to present indications a valuation of the property of the Toronto railway system and the Toronto electric light system will be secured by the city council from a qualified engineer to assist in negotiations for the purchase of these properties.

Vernon, B. C.

Representatives from the Vernon (B.C.) city council visited Vancouver early in May to report on the cluster lighting system in vogue here with a view to its adoption in Vernon.

Vancouver, B.C.

The Silver River Power Company, Limited, has been incorporated, head office at Vancouver.

According to advices received from Dawson, Y.T., early in May, the plant of the Dawson Electric Light and Power Company has been completely destroyed by fire, the total loss being estimated at approximately $200,000. The serious nature of the mishap may be gauged from the fact that the plant generated all the light and power for the city, and pumped the water from the entire system of pipe lines furnishing water throughout the district.

The Vancouver City Council recently endorsed a by-law which provides that 25 per cent. of the maintenance of the ornamental cluster light standards installed on certain streets will be defrayed by the city, and in future the property holders will be relieved from paying 25 per cent. of the cost of maintenance and furnishing of light. All ornamental lighting throughout the city will come under the provisions of the by-law as soon as the cost upon which to base the charges has been ascertained. The streets upon which the cost has been definitely calculated are as follows: Main street, $10.30 per 25 feet per year; Cordova street, $7.76 per year per 25 feet; Pender street, $8.52 per year per 25 feet; Hastings street, Main street to Jackson avenue, $7.25 per 25 feet per year.

The question of cheaper power for lighting purposes was discussed at a recent meeting of the Central Ratepayers

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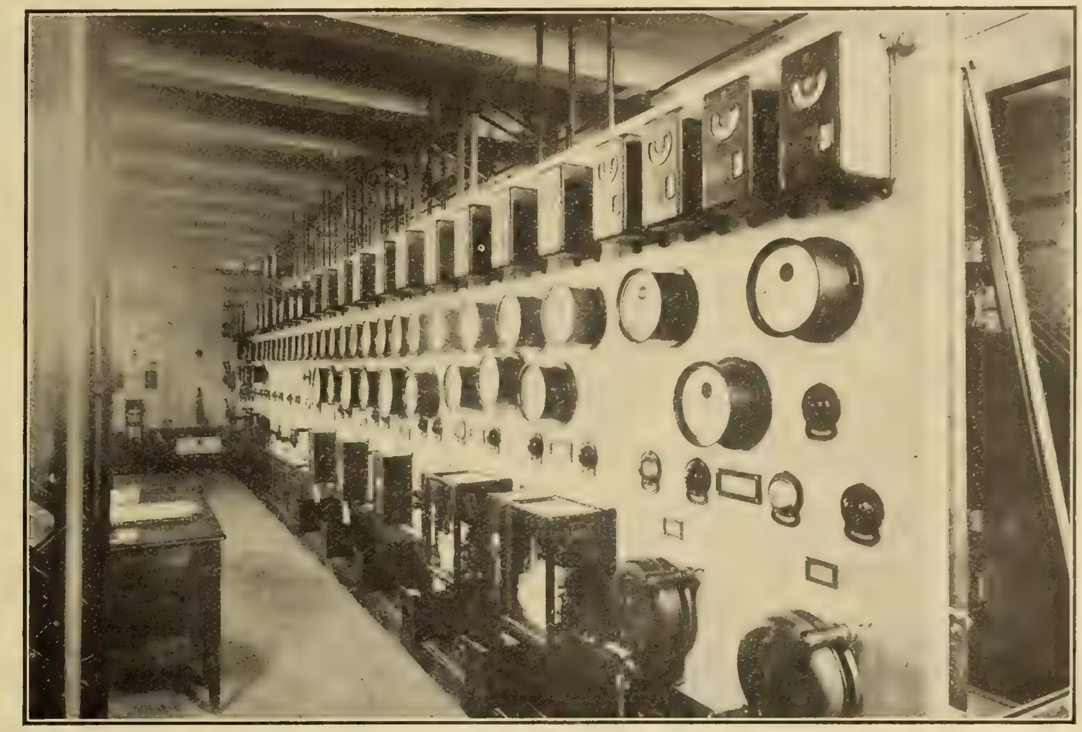

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Executive, Vancouver, the general feeling being that citizens were compelled to pay too highly. It was pointed out at the meeting that Winnipeg citizens pay 3 cents per kilowatt hour as compared with the prevailing rate of 11 cents in Vancouver. A committee was appointed to investigate the charges for electric light in other cities, and to report their findings to the city council committee that looks after B. C. Electric Railway Company's matters.

Welsford, N.B.

Letters patent have been granted the Welsford and Hampstead Telephone Company to install and operate a general telephone business in the district.

Winnipeg, Man.

An electrically operated pump has just been placed in operation in the waterworks station on McPhillips street.

Tenders will be received to June 5, by the city of Winnipeg for extensions to the terminal station on Rachel St.

A contract has been awarded by the Board of Control to The Crane & Ordway Company, 93 Lombard street, Winnipeg, for galvanized meter fittings.

Walkerton, Ont.

The Walkerton Electric Light & Power Company are at present putting the finishing touches on their dam and power house at Walkerton. The power house is built of reinforced concrete up to the first floor, but above this point it is brick. There are two draft tubes for two main wheels and one smaller tube for the exciter wheel. The exciter turbines may be fed from the pipes supplying either of the larger wheels as desired. Only one water wheel will be installed at present, having a capacity of 235 h.p. at present. This wheel will be controlled by Lombard governor. The generator will be of the Swedish General Electric vertical type, 3-phase, 60 cycle, 2300 volt. The intention is to operate this new machine in parallel with the equipment already installed in the plant. Mr. J. T. Potter is electrical superintendent of the Walkerton Electric Light & Power Company and Mr. A. Richley is construction engineer on this work.

Walkerville, Ont.

The Walkerville Light & Power Company will increase their capital stock from $25,000 to $100,000.

Excavation work has been commenced by the general contractors, DeLisle & Cooper, of Detroit, on an auto-lamp factory.

Yorkton, Sask.

A contract has been let for the construction of the new power house to Messrs. Ritchie & Waters. The building will be of fireproof construction and built of red brick.

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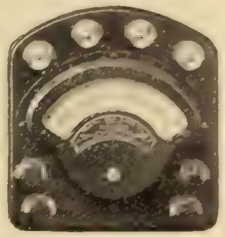

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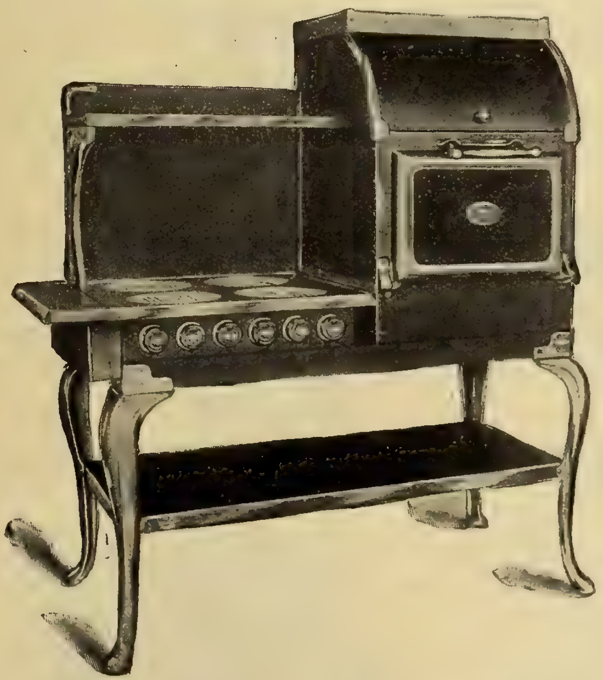

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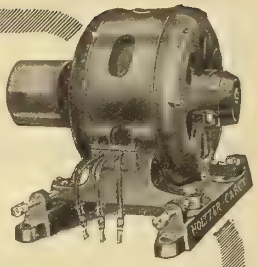
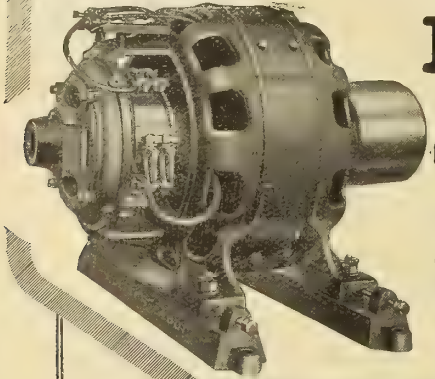


Holtzer-Cabot

MOTORS



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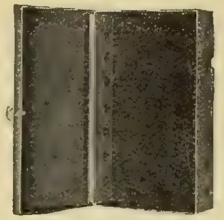
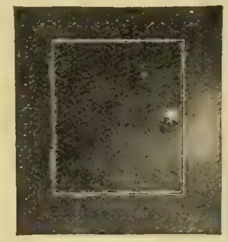
—prompt shipment from stock in standard sizes and styles at lower prices than you have been paying.

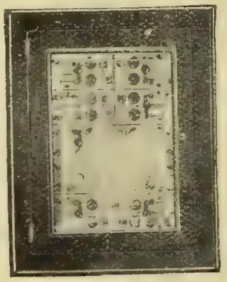


Type A—The usual box dust tight cover

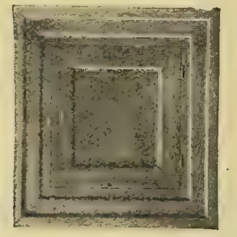


Type P—A medium price box with a door and trim

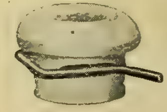
Type C—A high-class one, beaded and paneled



Type G. With a beveled plate glass panel in door.



Type SW. Steel, with natural oak, mahogany or walnut finish.



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Save money by getting aquainted with the line.

Write to-day.

COLUMBIA, 232 E. 144th St., New York

You Can Interpret the Code Instantly with McLoughlin's

Questions and Answers

on the

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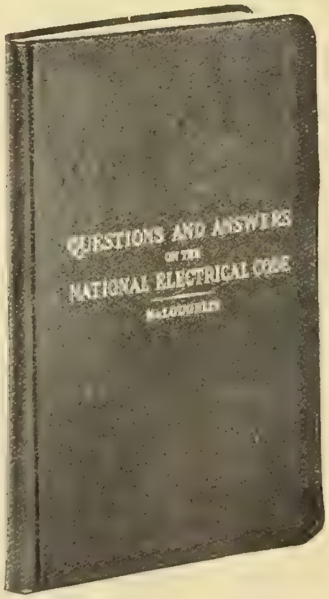

It tells at once the answer to the question on code requirements.
Contractors, electricians and wiremen write us that it hits the mark for them. It saves time, trouble and real money.
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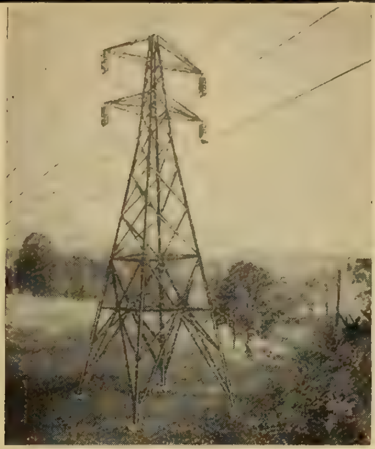

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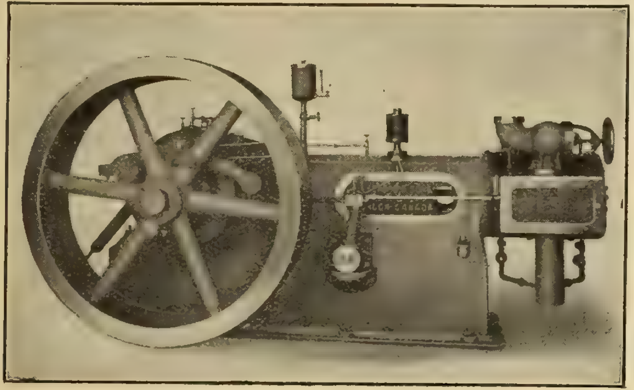

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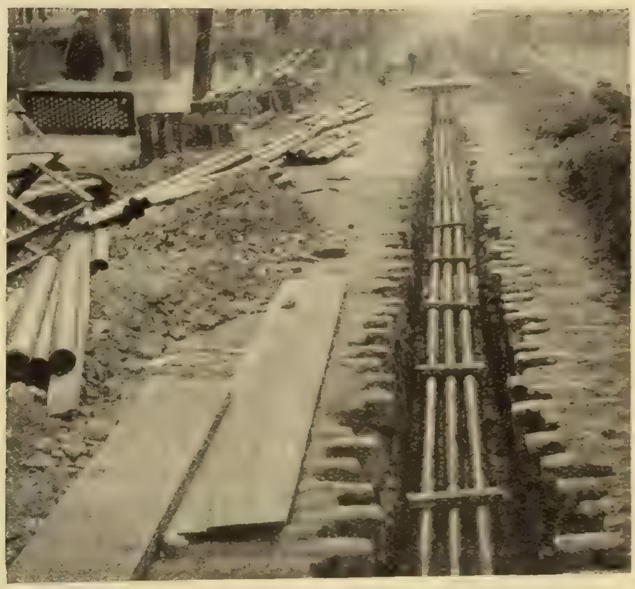

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Long Lengths 7 ft. Thick Walls ⅜ inch
Long Joints ⅝ inch

We will absolutely guarantee puncture strength 50,000 volts absorption for 100 hours less than ¾ of 1%.
Comparison of above figures with other types of Fiber Conduit will show the superiority of

"AMERICAN BITUMINIZED FIBER CONDUIT."

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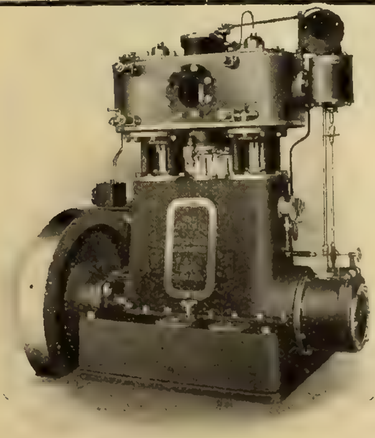

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With Combined Throttle and Expansion Governor

These engines are giving excellent service wherever installed. They are built for service and are economical in consumption of steam and require little or no attention while running. The materials used are in accordance with British Admiralty Specifications. Ask for detailed information.

All Engines are Tested under Steam before leaving our works

THE GOLDIE & McCULLOCH COMPANY, LIMITED
Head Office and Works: Galt, Ontario, Canada

Branches:—Toronto Montreal Winnipeg Vancouver and St. John, N. B.

Condensed Department

FOR SALE

Tenders wanted for purchase in whole or in part of the following apparatus:—

1 20 h.p. 220 volt, 60 cycle, C.G.E. Motor, complete.
1 5 h.p., 220 volt, 60 cycle Westinghouse Motor.
2 5 h.p., 110 volt, 60 cycle, Westinghouse Motors.
1 2 h.p., 110 volt, 60 cycle Westinghouse motor.
1 Goldie McCulloch Wheelock Engine, 125 h.p., 20 x 50 x 16 x 50.
1 Laurie Corliss Engine, 90 h.p., 13 x 30.
2 Northey condensers and pumps, 8 x 12 x 12.
36 ft. 4-in. line shafting, complete with vertical shaft hangers and boxes and 2 friction clutches.
2 belt tighteners.
1 pulley, 46 x 23½.
1 pulley, 30 x 22.
2 pulleys, 19½ x 17.
1 pulley, 17½ x 72.
1 pulley, 5 x 28.
79 ft. 2-ply, 17½-in. leather belt.
61 ft. 2-ply, 16-in. leather belt.
82 ft. 19½-in. leather belt.
Approximately 100 ft. 4-in. steam pipe with valves and fittings complete.

All the above apparatus in first class shape but has been discarded owing to the introduction of Hydro-electric Power and may be seen at the Pumping Station, St. Mary's, Ontario.

H. M. MILLER,
Sec. W. L. & H. Commission.
St. Marys, Ont.

10-11

Hydro-Electric Power Commission of Ontario

Wasdell's Falls Power Development

Sealed tenders addressed to the Hon. Adam Beck, Chairman, Hydro-electric Power Commission, Continental Life Building, Toronto, will be received up to noon of June 16th, 1913, for the various classes of work in connection with construction and equipment of a hydro-electric power plant at Wasdell's Falls, on the Severn River.

Separate tenders will be received under the following heads:—

Tender for Dam and Power House.
Tender for Electrical Equipment.
Tender for Hydraulic Equipment.
Tender for Crane.
Tender for Stop-log Winch.
Tender for Head-Gate Mechanism.

Plans, specifications and instructions to bidders may be obtained at the offices of the Hydro-electric Power Commission, Continental Life Building, Toronto.

Tenders for Dam and Power House must be submitted on Form of Proposal supplied by Commission.

An accepted cheque for Five Dollars payable to the Secretary of the Commission, must accompany all requests for plans and specifications for Dam and Power House, said cheque to be held until plans and specifications are returned, either with or without a tender.

By order,
W. W. POPE, Secretary.

This advertisement will not be paid for unless inserted by authority of the Commission.

Wanted

WANTED—Second-hand generators. 1—60 kw. 1—150 kw., 1—120 kw., 1—200 kw., 3 phase, 60 cycle, 2200 volt machines, for belt drive, must be in good condition and by some standard maker. Box 780, Electrical News, Toronto, Ont. 9-12

Situations Vacant

WANTED—Bright, energetic young man, college graduate, electrical with mechanical ability to learn established manufacturing business located in Toronto. Advise fully as to experience, training, age and references. Box 803, Electrical News, Toronto, Ont. 11

Situations Wanted

Electrician, experienced in wiring, operating and repair work, wants position as maintenance man in large power plant or similar position. Box 802, Electrical News, Toronto, Ont. 11

Young man, 22, four years experience in charge small plant, desires position as superintendent's assistant in power plant. Engineer's certificate for Saskatchewan and good general knowledge of electrical work. Box 800, Electrical News, Toronto, Ont. 11-12

Technical graduate familiar with plant and switchboard design, test and manufacturing of electrical apparatus, seeks position connected with the design or construction of hydro-electric power plant, around Montreal preferred. Would like to start as designing draughtsman. Has also experience in surveying and underground construction. Speaks English and French. Best of references. Apply Box 794, Electrical News, Toronto, Ont.

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Write for Samples and Prices
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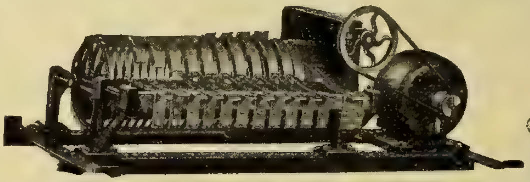

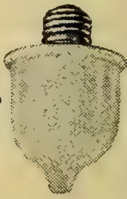

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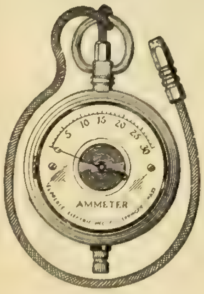

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4 Forms—1 Result—A Perfect Joint
We don't ask you to take our word for it that **YAGER'S** Fluxes are the best—we want you to give them your severest test **AT OUR EXPENSE** and prove it for yourself. Send to us for samples of the kind you want, with your dealer's name and address and make your own tests.
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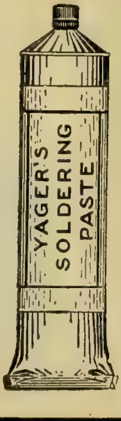

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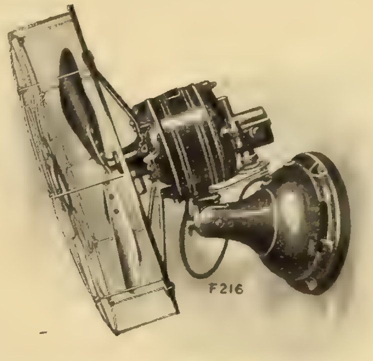
They're business-boosters for you. Write us for circular showing the series—you'll find them the most interesting, convincing fan-talks that have ever appeared.

Don't let your order wait long. One hot day may lose you half-a-dozen sales—and hot days are coming.

If you want to sell popular, well-advertised Fans, tie up to the "Standard" Line.

Robbins & Myers "STANDARD" Fans

Have been preferred by fan buyers for 18 years. Their steady, silent, powerful operation, reliability without breakdown or repairs, and economical use of current, make them rapid and satisfactory sellers. If quality and reasonable prices count with your customers, supply them with "Standard" Fans.



Model 11 Gear Type Oscillator in Wall Bracket Position.

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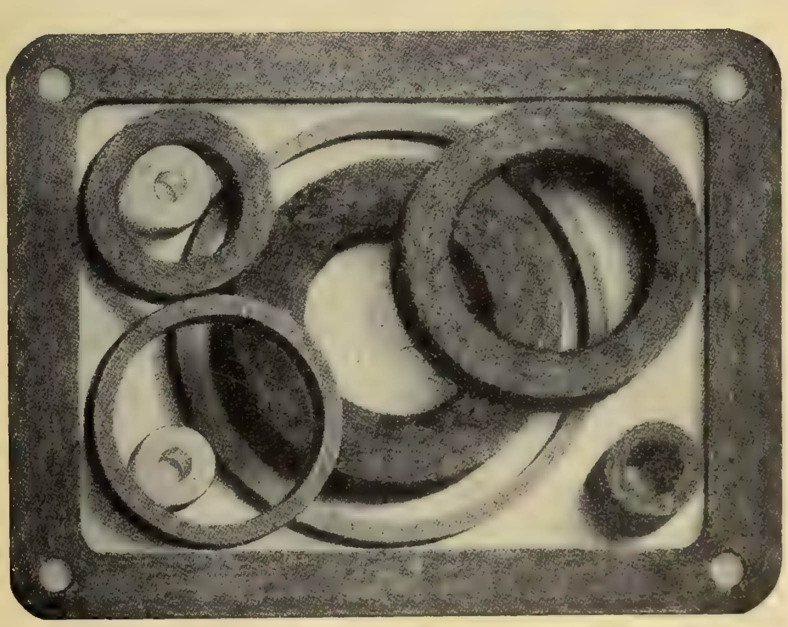

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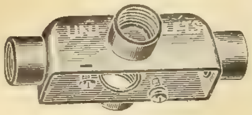

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Rectangular Steel Unilets for ½-in. to 3-in. Conduit Inclusive

Successful Contractors are those using up-to-date fittings

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are the ideal fittings for up-to-the-minute work and for neatness in appearance and durability they cannot be surpassed. Catalog No. 6 and Booklet sent upon request. May we send you copies?

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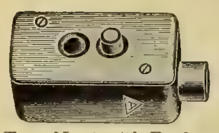

Type No. 1 with Push Button Switch attached

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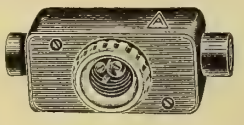
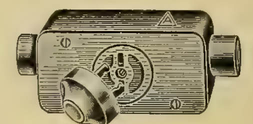
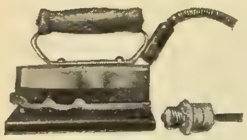


Type No. 2 with P. & S. No. 577 Receptacle attached



Type No. 2 with Hubbell No. 5118 Receptacle attached



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Unique in that the heater (covering the entire ironing surface) actually is **the bottom** of the iron. Hence more and quicker heat for less current than any other iron of equal capacity. Thoroughout of Simplex Quality—efficiency with comfort to the user. Do you know about **the range** that has revolutionized electric cooking? Send for the new book. **"It Means Freedom."** It will help you.

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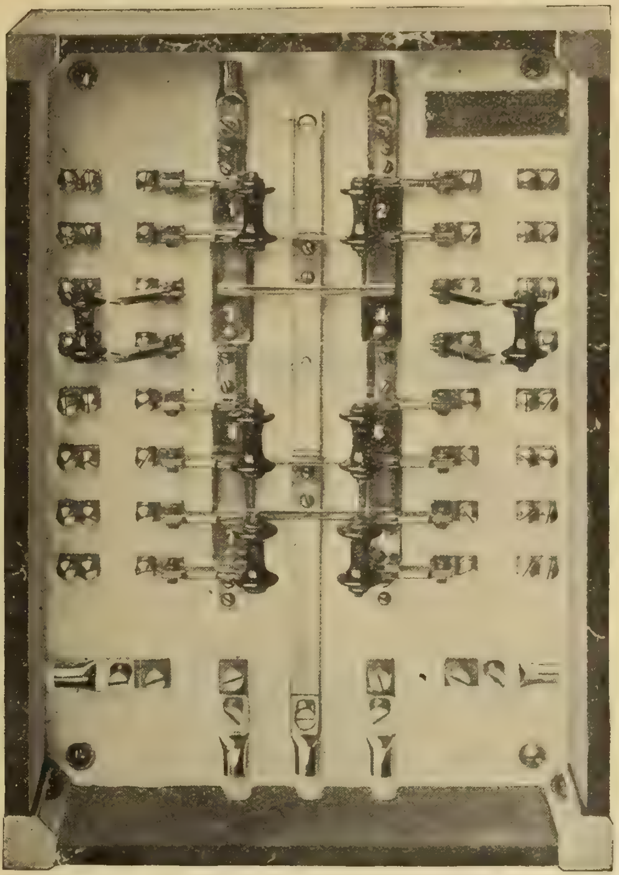

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Because "Krantz" Switch Boards and Panel Boards are the recognized standard, always reliable and comply with every requirement of the Underwriters' Association.

They are used in many of the largest institutions, office and government buildings throughout Canada and the United States.

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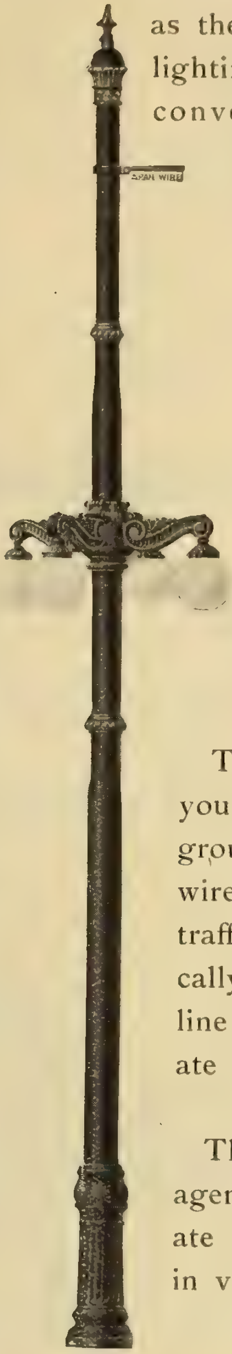

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as the basis of your new street lighting system. You can easily convert them into attractive Mazda Lamp Standards or arc lamp supports by use of

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Fixtures

This system, besides saving you the expense of underground construction, gets the wires up out of the way of traffic, where they are practically unnoticeable and the curb line is not crowded with separate lighting standards.

The progressive railway management will gladly co-operate with you with this object in view.

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He TELEPHONES instead of writing, walking, or riding, whenever he can, therefore saves energy and doubles his efficiency.

The more subscribers can be induced to telephone the greater will be the demand for your service and new contracts.

The better the telephones, the greater inducement to use them, and the better the service, the greater the need of it becomes. Here is where really fine equipment is the best possible directory builder.

The telephone today is not used but a fraction of what it will be a few years hence. Therefore, the better the apparatus (which means better service), the faster will its use spread.

Thousands of wasted steps are taken daily; thousands of pounds of shoe leather worn out uselessly, and what is perhaps the most important of all, hours of valuable time are thrown away; 90 per cent of which can be saved by telephoning.

The highest class telephone service known to the telephone field today is exemplified in the Kellogg equipment. Every part in its construction is sound.

Send for our bulletins. They are REAL sources of information. Not merely a description of the apparatus but simple readily understood explanations of its operation.

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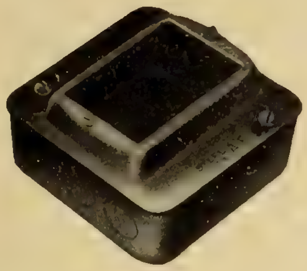

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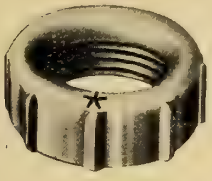
You cannot afford to use a box requiring more labor to install. Clean-Cut Knockouts. Sherardized or Enameled Finish. Packed in Heavy Paper Cartons and Wood Cases.



"Star" Bushings

The kind the wireman likes. The name is famous and the bushings have been favorites since they were first manufactured.

Also "Fullman" Floor Outlets, "Universal" Insulator Supports, Fixture Stems, "Superior" Fish Wire, Conduit Benders, Beam Straps.

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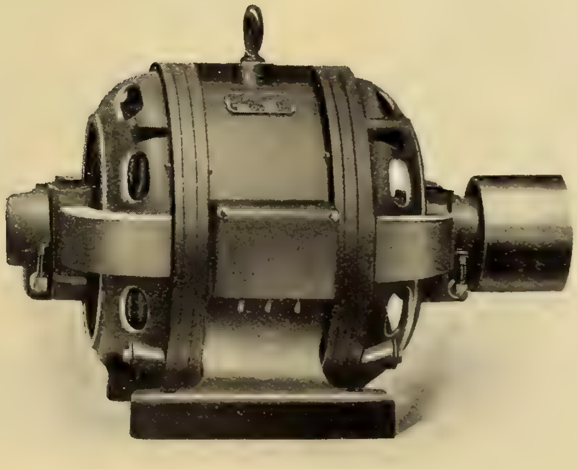
STEEL CITY ELECTRIC CO., Pittsburgh, Pa.

The Canadian UNION Electric Co.

Limited



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We are now handling both Western Red Cedar and Northern White Cedar Poles. Write for prices. Quick shipments.

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For prices on B. C. Cedar Poles address

WESTERN LUMBER & POLE COMPANY
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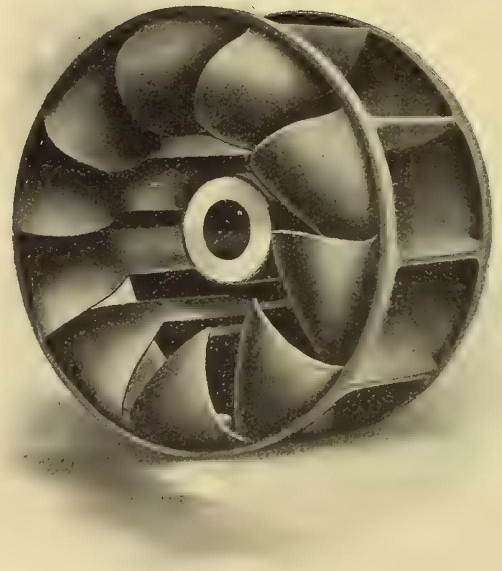
Real Service

Our British Columbia Poles are especially adapted for transmission line construction. They are straight, sound-butted and strong, and in the longer lengths, the cheapest. You will have them shipped on time and every one will be fully up to requirements. Let us quote on your next requisition.

The Lindsley Brothers Co.
"Good Poles Quick"
Spokane Washington



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Normal in speed and discharge, giving the greatest range of high efficiency for working conditions.

Conserve the Water Powers.

Write for Catalogue and References.

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Pole Line Material

We can furnish any quality of arms, pins, brackets, or pole line hardware you call for if you can wait for factory shipment, but stock only which carries our guarantee.

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This includes: Washington Fir not less than 85% heart, Georgia Pine—Long Leaf—not less than 75% heart Kyanized—Spruce. Pins and Line Hardware—A T and T specifications.

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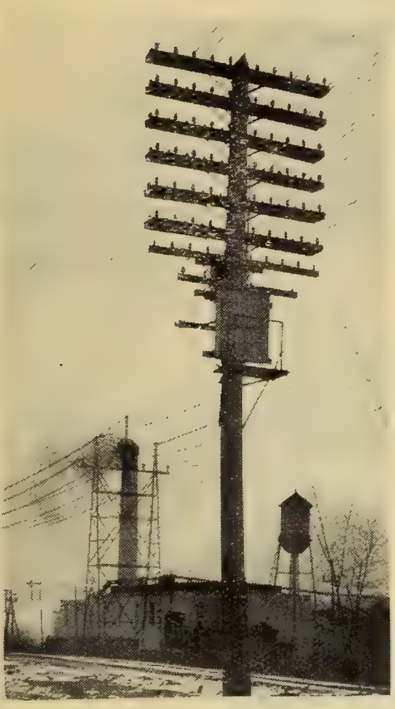

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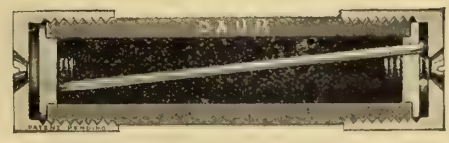

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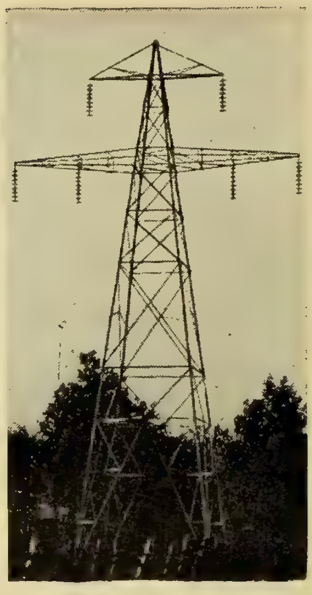

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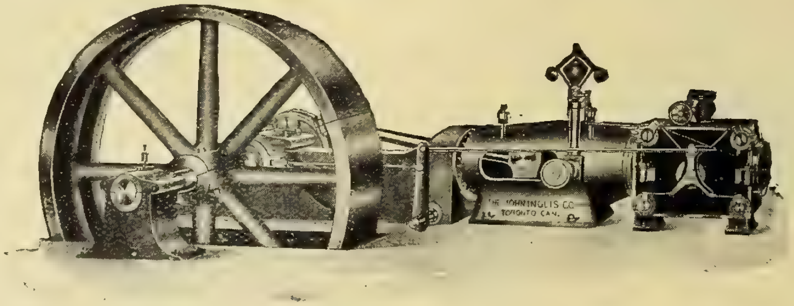

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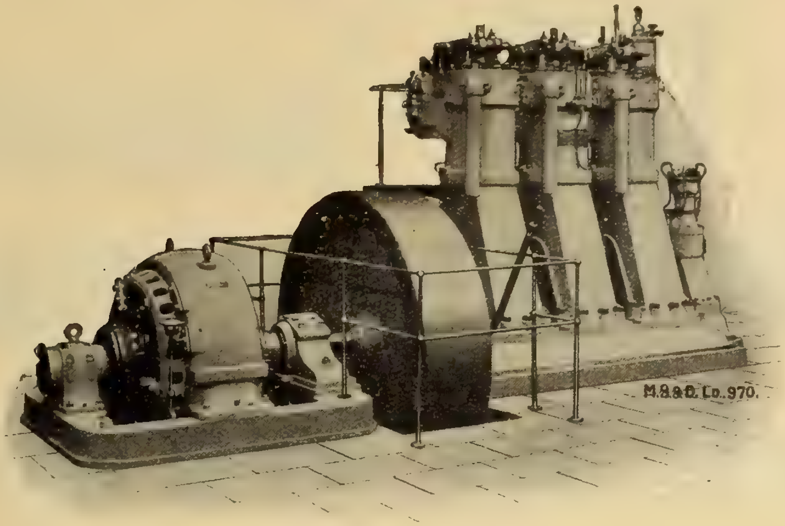

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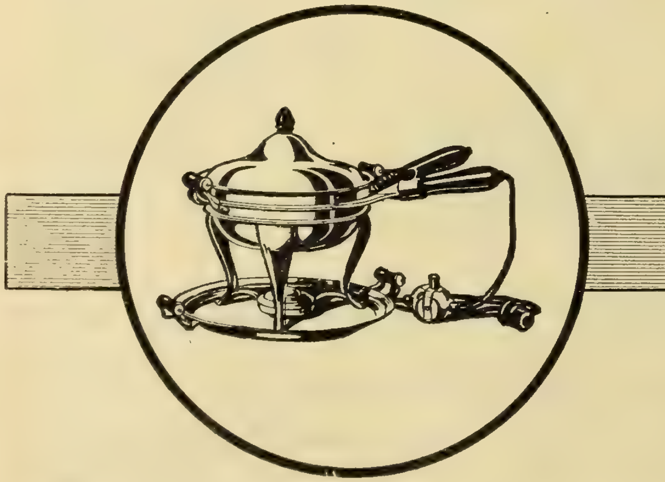

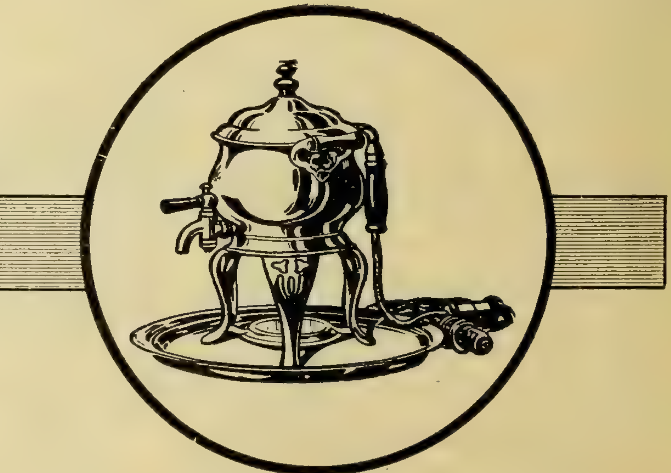

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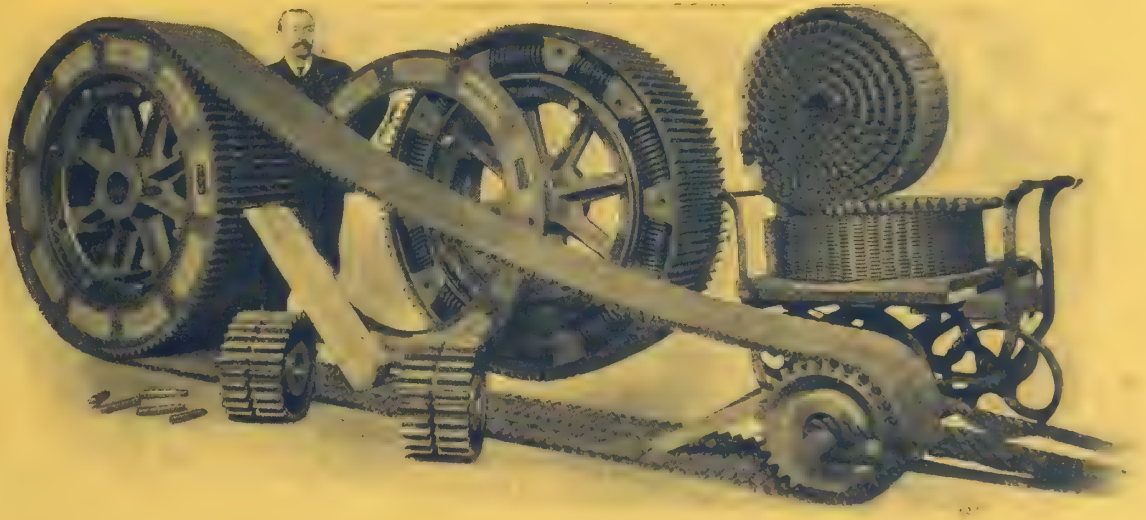

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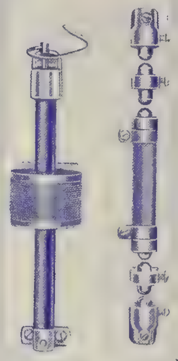
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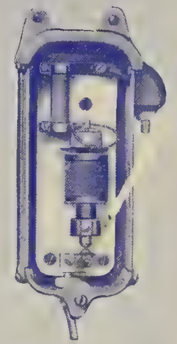
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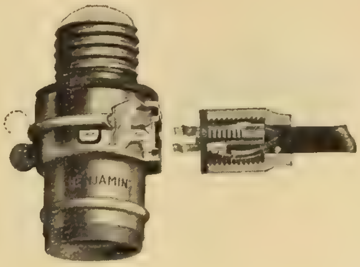

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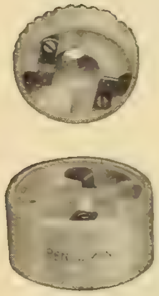

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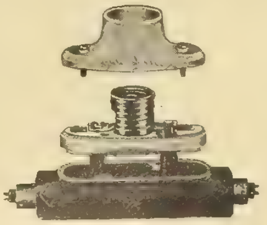
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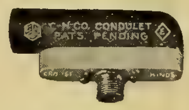
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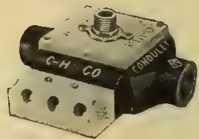
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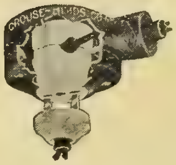
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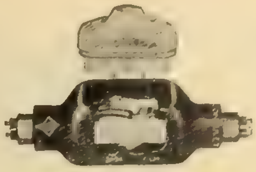

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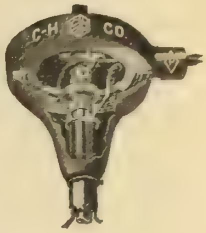

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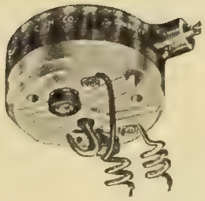

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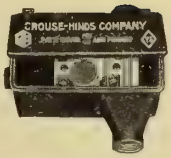

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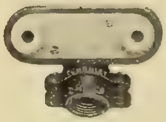

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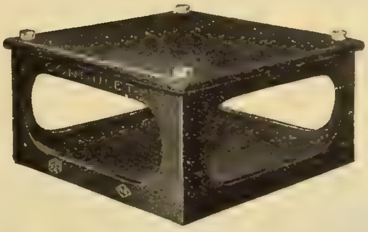

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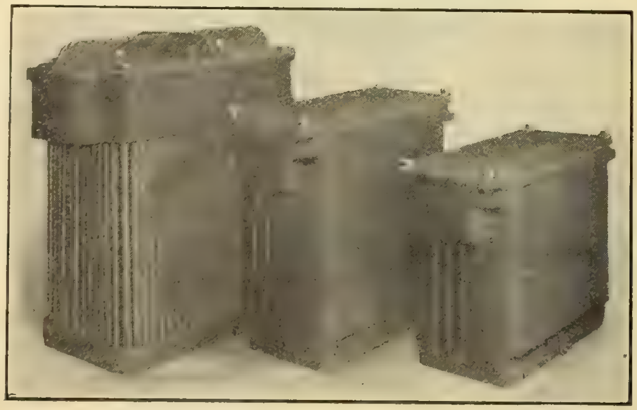

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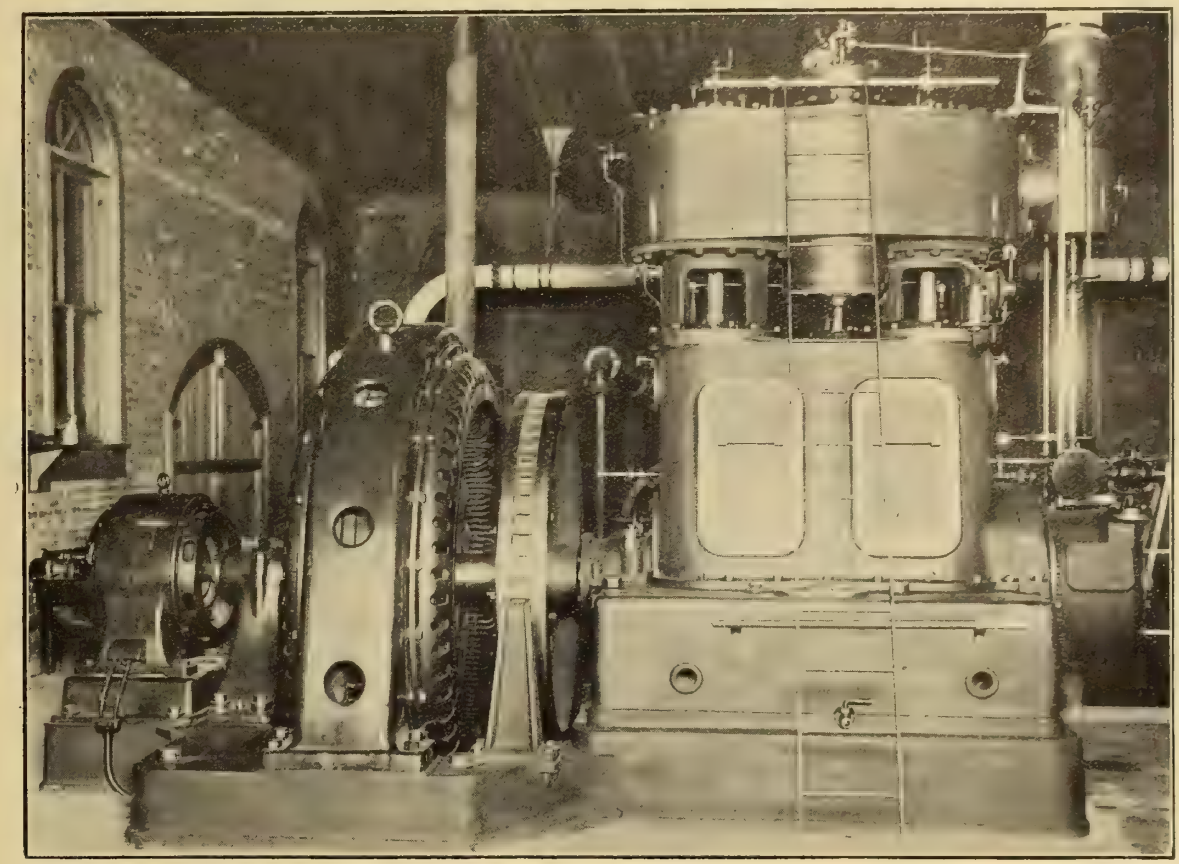

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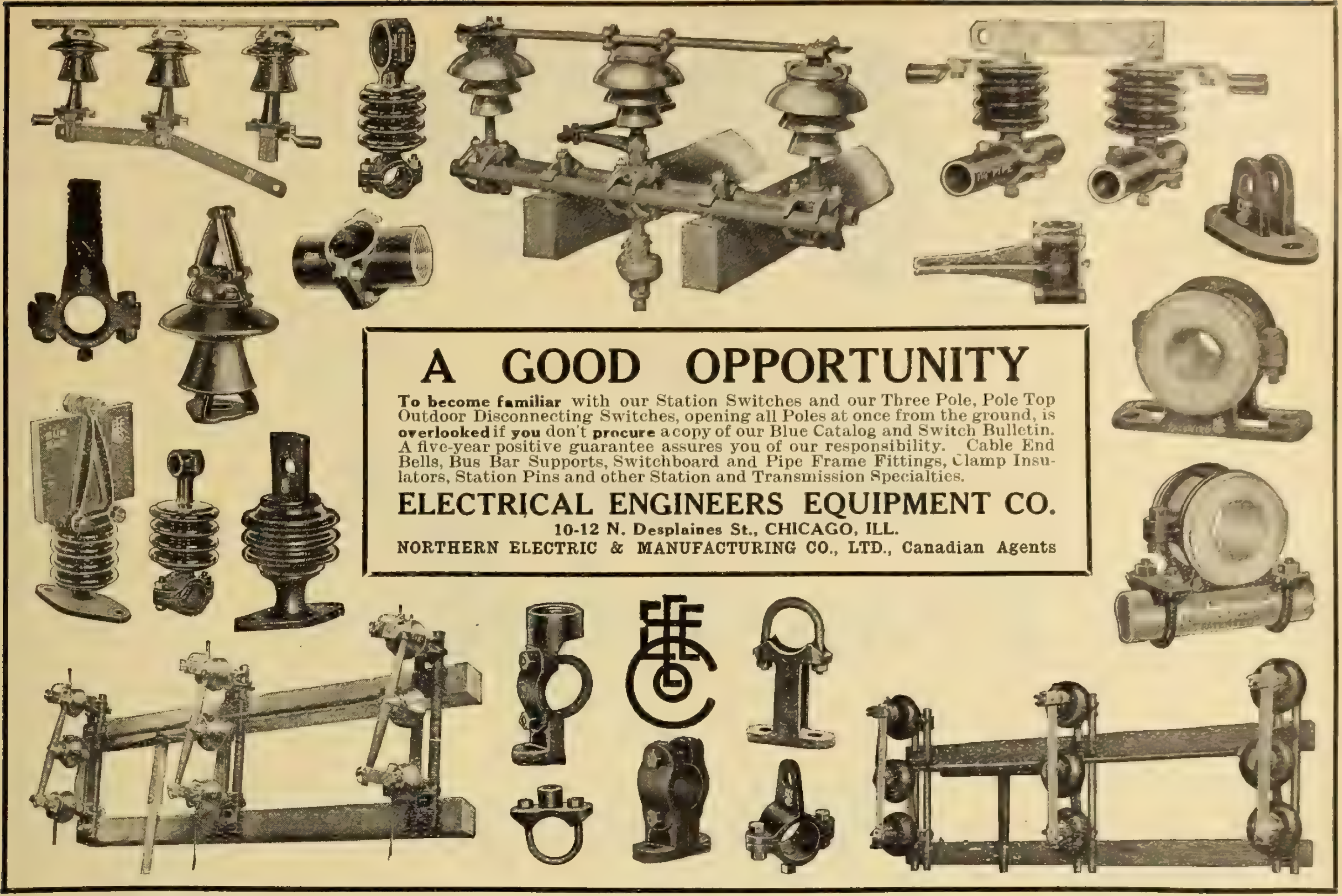

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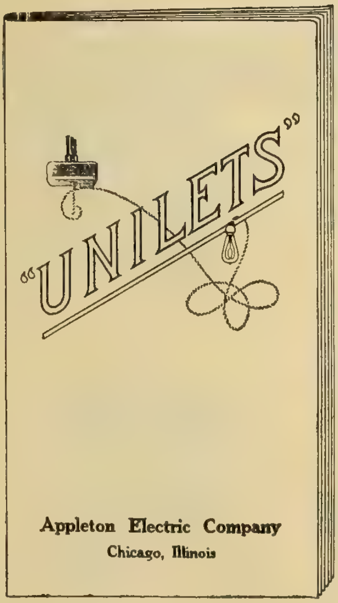

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Chicago, Illinois

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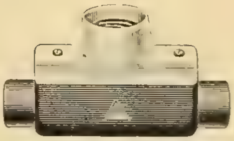

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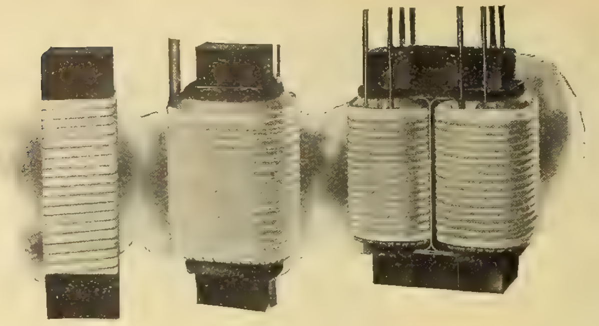

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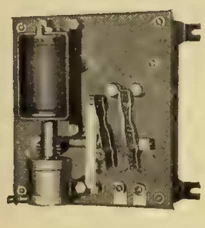

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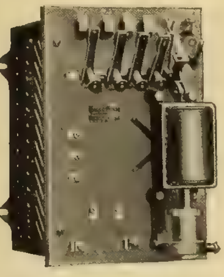

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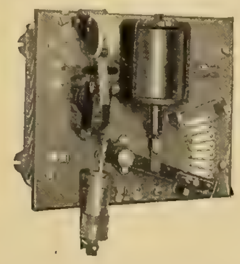

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45 Bulletins—164 Pages

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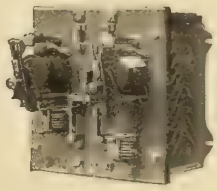

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New Multiple Solenoid Type Automatic Controller. Described in Bulletin 6160.

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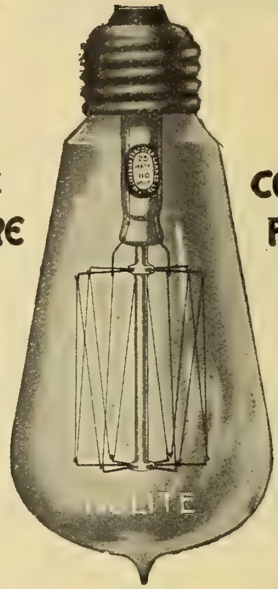

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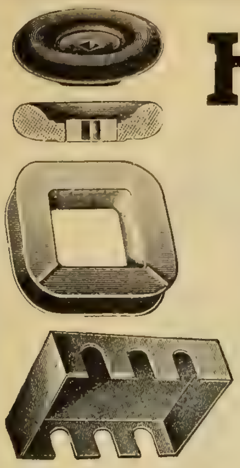

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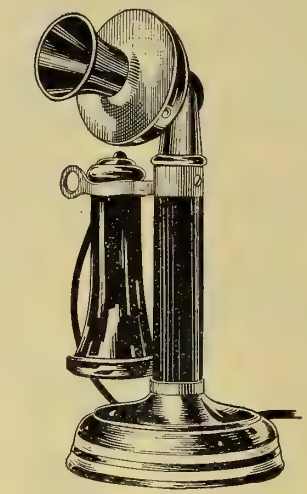

"Kellogg" in modern telephony means High Class Service—Low Maintenance

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"The certainty of quality is evident long after the price is forgotten."

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Bulletin No. 61—C. E. on Common Battery Telephones.

No. 55—C. E. on Telephone Apparatus.

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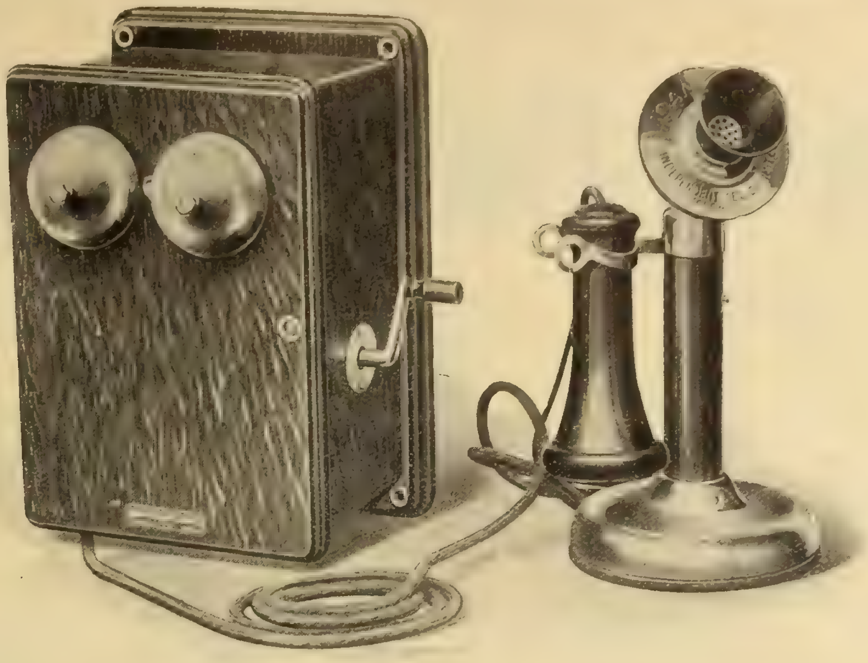

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High standard of quality in a telephone is best shown by years of satisfactory service—good service from a telephone that demands little or no attention.

That is how our telephones have shown their quality.

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Municipal telephone systems are developing in Ontario. Of the last seventeen municipal systems built, sixteen are using our telephones. That is getting your share of the business—and it could not have been secured in the face of the present keen competition unless the municipalities establishing these new systems had received from the municipalities that had been using our equipment for years, favorable reports and the strongest recommendations.

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Other sizes—several styles
12 - 22 - 32
Station Capacities

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¶ The Grecian Lanterns and Canteloupe Ball Globes are made in five different sizes—illustrated in Moonstone Bulletin No. 1

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The Jefferson Glass Company
Limited

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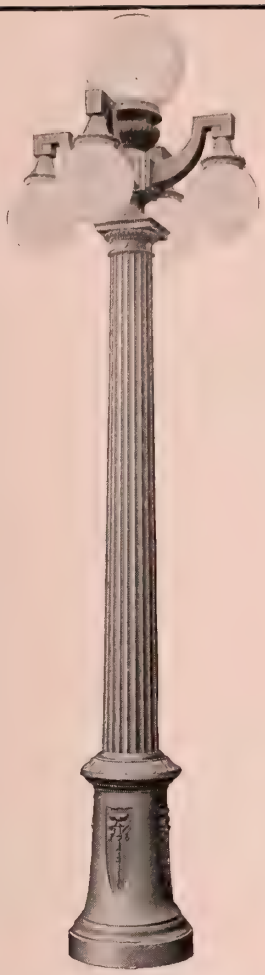
TORONTO CANADA



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Luxolabra will meet your requirements for Ornamental Illumination, being "built up" of high grade Steel, insuring maximum strength, durability and artistic appearance.

Our recent installations and ones under construction in the following towns, are:—

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Recognized superiority in design, efficiency, electrical and mechanical construction. Built along practical machine tool lines for long continuous hard service. You can connect our machines to your regular lighting circuit. Simplify your drilling and reaming operations by employing the modern up-to-date method of transporting machines to the work instead of work to the machines. You will quickly appreciate the saving in production costs. Types and sizes for all classes of service.

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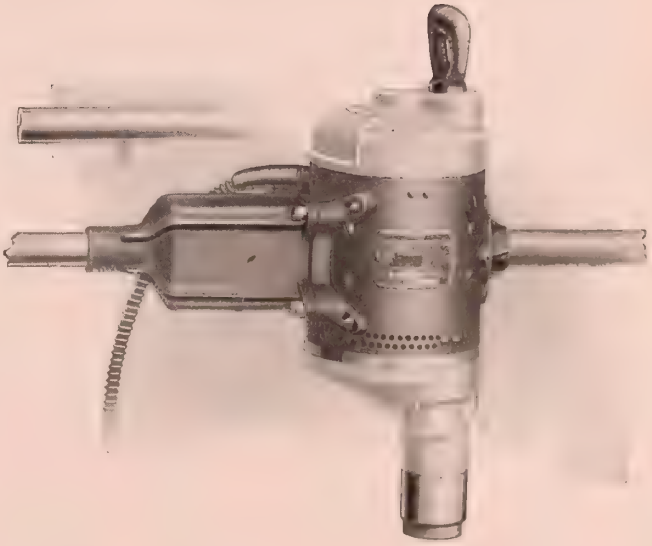

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Hubbell Receptacle No. 5418

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The current-carrying parts, imbedded in a block of porcelain, cannot be touched, voluntarily or involuntarily, by fingers or foreign substances. This feature is original with HUBBELL. Other receptacles have wide open contacts which frequently and unpleasantly shock the users when making or breaking connections.

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Interchangeable

Plugs and Receptacles

Are Luxurious Necessities

They cannot be dispensed with on either count in any home or office building. They increase the convenience of portable electrical devices and you know what these do as increasers of current consumption, profits on sales and wiring.

Any Hubbell Plug fits any Hubbell Receptacle. With Receptacles in every room of the house and office building, your customer can instantly draw any kind of heat, power or light out of the walls, as Mephistopheles drew any kind of wine out of the table,—heat for the sad-iron, percolator, chafing dish, toaster; power for the fan, sewing machine, vacuum cleaner, washing machine; light for the portable lamp. All of which is transmuted into golden profits for you.

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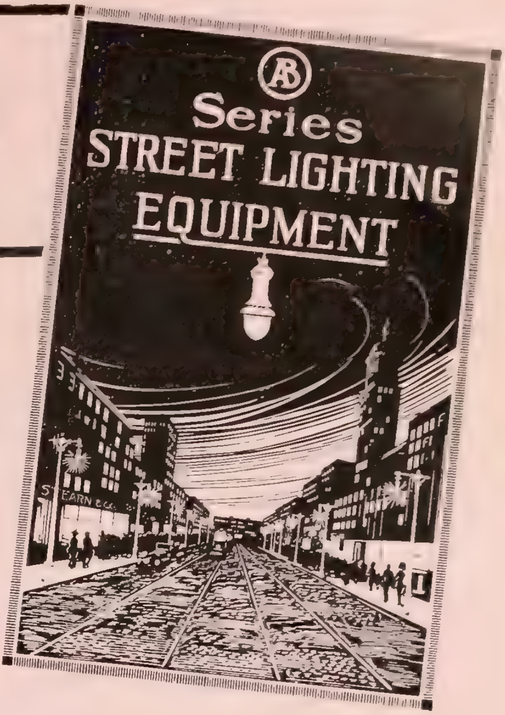
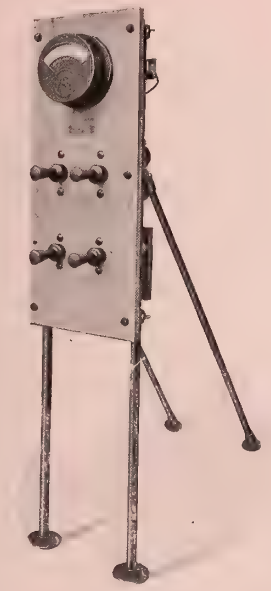


Series
STREET LIGHTING
EQUIPMENT

Every central station manager needs the complete and exhaustive data on series lighting equipment contained in this catalog. It is the result of 12 years specialization in this field and the information is necessary to a thorough knowledge of modern street lighting. ***Ask for Catalog 120.***



A-B Constant Current Transformers

Combine the functions of the Constant Current Regulator and Constant Potential Transformer.

The close current regulation—always within 1 per cent. of normal—is especially important where series Mazda Units are used. The electrical construction and insulation is such as to reduce losses to the lowest possible amount and to insure operation at low temperature.

Our C. C. Transformers are compact, rugged and exceedingly simple, **Single or Double Circuit.** Sizes 4—8—16—22—32—50—64 Kilowatts.

A-B Panel Boards

For Series Mazda Circuits or Series Flame Arc Circuits, equipped with Plug Switches for voltages over 4,500. Oil Switches for higher potentials. Single or Double Circuit.

A-B Series Flame Lamp

The A-B Series Lamp is the logical successor to the series enclosed arc lamp for street lighting.

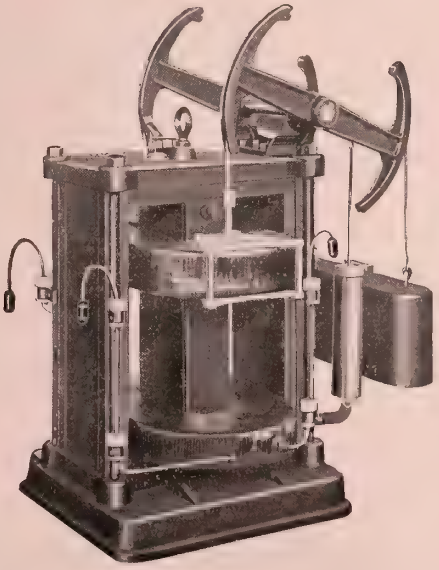
It has the same electrical and mechanical characteristics and the same current consumption. In addition, the series flame lamp possesses many points of merit over all types of series street lighting units now in use, and has the advantage of color volume of light and simplicity of station equipment.

The series flame lamp is placed lamp for lamp on present enclosed arc circuits. This means that for an installation of series flame lamps no additional station equipment is necessary.

A-B Series Mazda Equipment

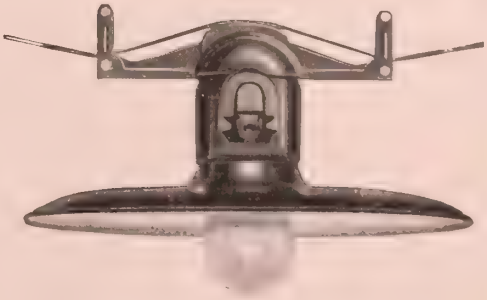
A line of standard reflectors and attachments for series Mazda Units, made for center span suspension or with pole arm and bracket.

The A-B Series Street Hood has several novel characteristics not embodied in other types. It is compact in design and simple in construction. It represents the latest development in series Mazda Lighting Equipment.



The Adams-Bagnall Electric Co.

Cleveland, O.



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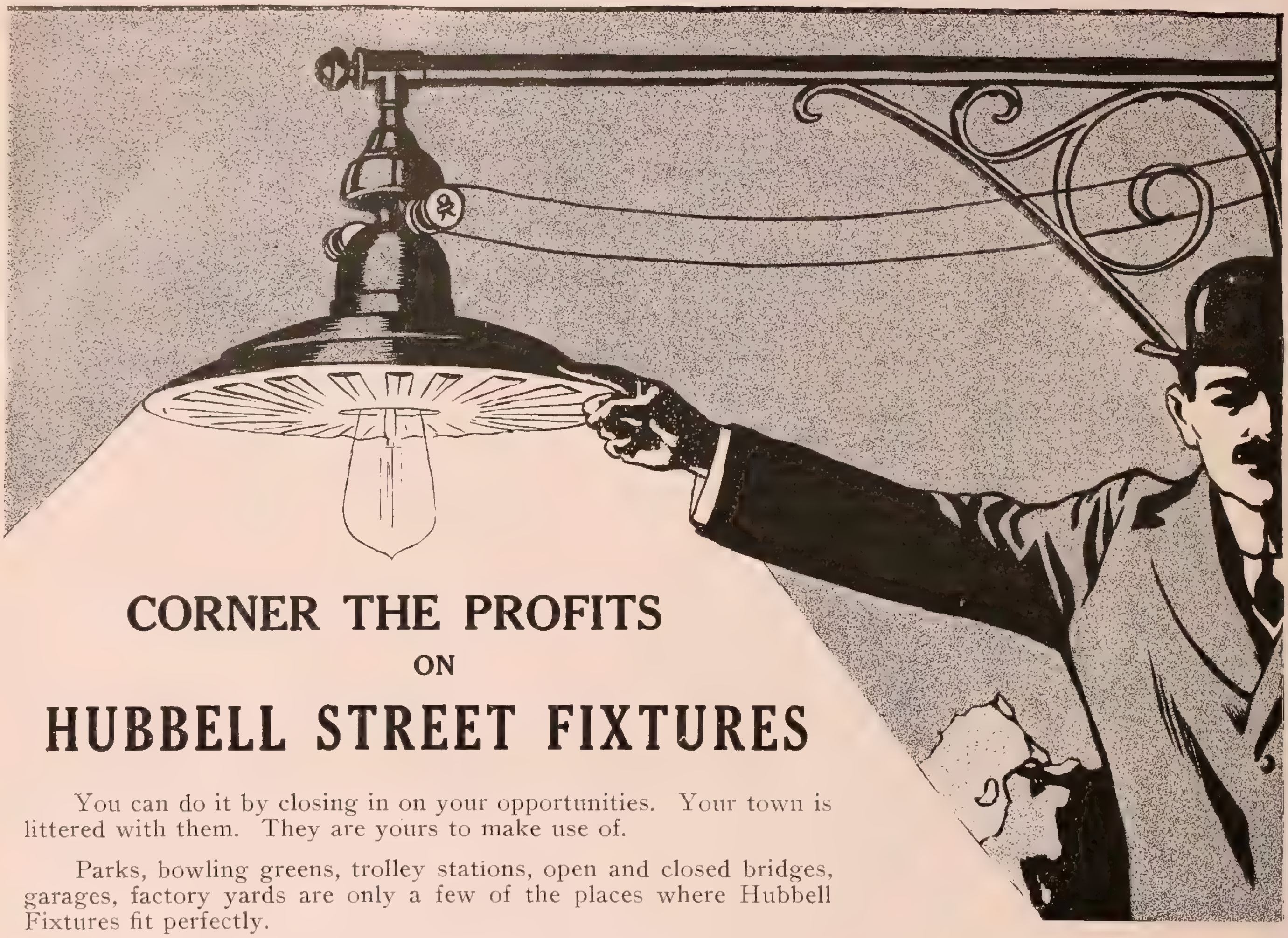

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HUBBELL STREET FIXTURES

You can do it by closing in on your opportunities. Your town is littered with them. They are yours to make use of.

Parks, bowling greens, trolley stations, open and closed bridges, garages, factory yards are only a few of the places where Hubbell Fixtures fit perfectly.

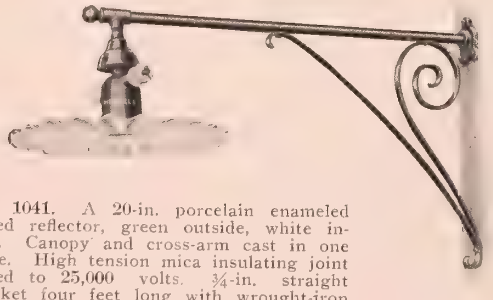
They are inexpensive, ornamental, easily installed on wood or iron posts, brick or cement walls.

Their rugged construction defies wind and weather and so the upkeep expense is kept down to the cost of replacing burned out lamps.

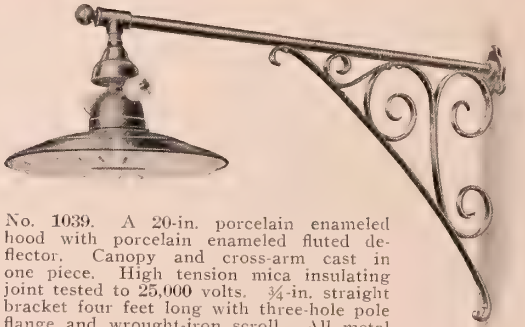
Work your wires for all they are worth. Load them with Hubbell Tungsten Fixtures. You'll find it will pay and pay big.

The New Hubbell Fixture Catalog is Ready for you

It is packed cover to cover with boiled down information about Hubbell Fixtures. It shows the entire line and will prove a handy helper at your elbow. Drop us a postal and we'll send your copy.



No. 1041. A 20-in. porcelain enameled tinted reflector, green outside, white inside. Canopy and cross-arm cast in one piece. High tension mica insulating joint tested to 25,000 volts. ¾-in. straight bracket four feet long with wrought-iron scroll and three-hole pole flange. All metal parts heavily enameled.

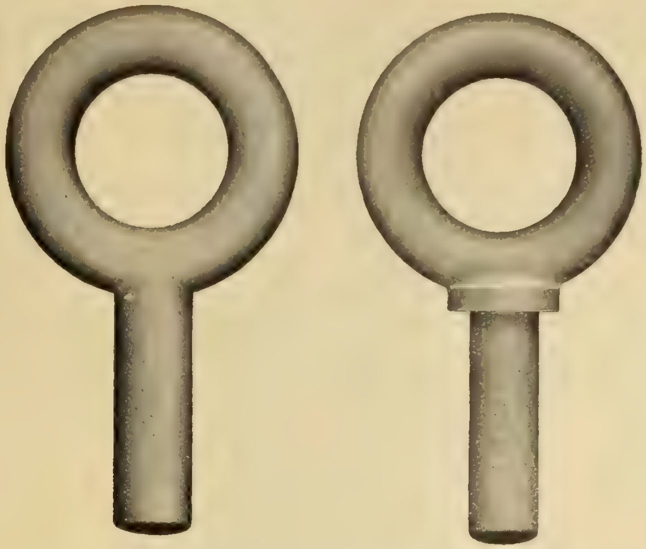


No. 1039. A 20-in. porcelain enameled hood with porcelain enameled fluted deflector. Canopy and cross-arm cast in one piece. High tension mica insulating joint tested to 25,000 volts. ¾-in. straight bracket four feet long with three-hole pole flange and wrought-iron scroll. All metal parts heavily enameled.

R. E. T. PRINGLE, 95 King St. East, Toronto

Toronto Montreal Winnipeg Vancouver

B
TRADE MARK



B
TRADE MARK

Eye Bolts, Blank or Threaded

Drop Forgings

Copper Commutator Bars, Copper Contact Fingers, Wrenches, Pliers, Turnbuckles, etc.

and Special Forgings of Any Kind

SEND MODELS OR BLUE PRINTS FOR ESTIMATES

Canadian Billings & Spencer, Limited
Welland, Canada

The JOVIAN ORDER

extends a hearty welcome to all members of the Canadian Electrical Association, guests and visiting Jovians.

¶ We invite all Jovians to attend the Rejuvenation and Joviation to be held Friday Evening, June 27th, 1913.

¶ Any member of the C.E.A., who is not a Jovian, can obtain the necessary application forms from the following Jovians:

TORONTO MANAGING COMMITTEE

EDWIN B. PIKE (1993) Statesman
MORGAN P. ELLIS (653)
S. C. DE WITT (8115)
JOHN WARD (4392)

H. G. NICHOLLS (2262) Alt. Statesman
W. W. LOVELL (156)
B. O. SALTER (6205)
A. R. OBORNE (8237)

"All Together, All the Time, for Everything Electrical."

THE TIME

Friday, June 27th, Eight P.M.

THE PLACE

Temple Building, Assembly Hall

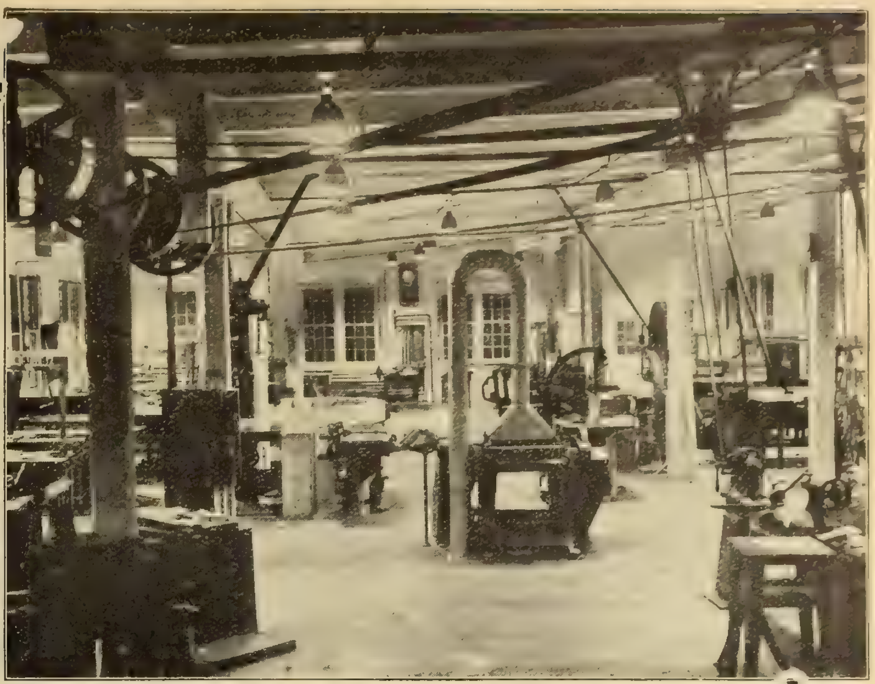
¶ Do not miss this Rejuvenation, it will be the most beautiful and elaborate Rejuvenation ever held in Canada.

¶ A perfect Degree team and special Jovian scenery will be used — it will be real Jovianism — as it should be.

REMEMBER—The Date—Time and Place

YOU ARE WELCOME

Here "Beehives" saved 1555 watts per hour



This is a typical example of **efficient** industrial lighting with X-RAY Direct Lighting reflectors in the Pattern Room of the Berlin Machine Works at Beloit, Wisconsin.

Notice the **hidden** lamps—the **absence** of glare—the **uniformity** of illumination—the **sharp cut-off** of the light on the walls preventing waste—the **cheerful** appearance of the shop —these factors are all-important considerations nowadays.

What Mr. F. F. Gorham, Engineer of the Berlin Machine Works writes is interesting reading. Also, it illustrates our point.

> May 16th, 1913.
>
> Although the photograph does not do the lights justice it shows how evenly the room is lighted, and also from the height of the men to the floor how thoroughly it is lighted.
>
> This room is 116 ft. long, 50 ft. wide and 13 ft. high. The roof is inclined, so that it is 12 ft. on one side and 14 ft. on the other. We have 40-100 watt lamps in Beehive reflectors placed 10 ft. centers, 9 ft. above benches. We formerly lighted this shop with 80-55 watt lamps, and three 3½ Ampere Arc lamps, making a total of 5555 watts formerly used against 4000 watts now used—a saving of 1555 watts per hour. Each bench and its table had three small 16 c.p. lamps. These aside from the annoyance due to handling were unsatisfactory in the lighting.
>
> There is not a single light now used other than the "Beehives." This effects a very material saving, as each workman was compelled to adjust his lamps to every new position he assumed. This required time, and as each man had three lamps they were quite busy adjusting lights.
>
> There is a shop room immediately below this Pattern Shop room that is exactly the same dimensions. This room is lighted with shallow bowl type of steel enameled reflector, same wattage as the Pattern Shop, same number of lamps. This room appeared to be very well lighted when first installed, but already there is complaint that they cannot see, due, I think, to the light not being properly applied. The direct rays or "glare" blinds the workman, and he tries to overcome it with an individual light. The workman suffers from the light, and does not know what is the matter with him.
>
> The writer installed on one floor where there are eight lathes "Beehives" in place of porcelain steel reflectors. This floor was lighted with steel reflectors formerly, and each lathe had an additional two 16 C.P. lamps for each lathe. The workman declared that it would not be possible to operate without the small lights. This floor is now operated without small lights, with the "Beehive" reflector only.

This job was secured by an electrical dealer. That's our policy. To sell **only** through the trade. And the trade **appreciate** it.

Why don't you get your name on our mailing list? We're constantly issuing mighty valuable lighting information. The result of 14 years' earnest work. You also get our complete loose leaf data book and catalogue. Remember, you can buy X-RAY reflectors in Canada.

NATIONAL X-RAY REFLECTOR COMPANY

General Offices
225 West Jackson Boulevard
Chicago

New York Office
Eye Comfort Lighting Shop
14 West 33rd. St.

What Your Customers Want

Is the most value for their money. Human Nature tells us if we give them something that really satisfies, they will return for more. It's your repeat orders that count.

Northern Lights satisfy. These high efficiency Mazda Lamps will give 2 or 3 times as much light for the same current consumed by the carbon types. They have long life and retain their efficiency to the end.

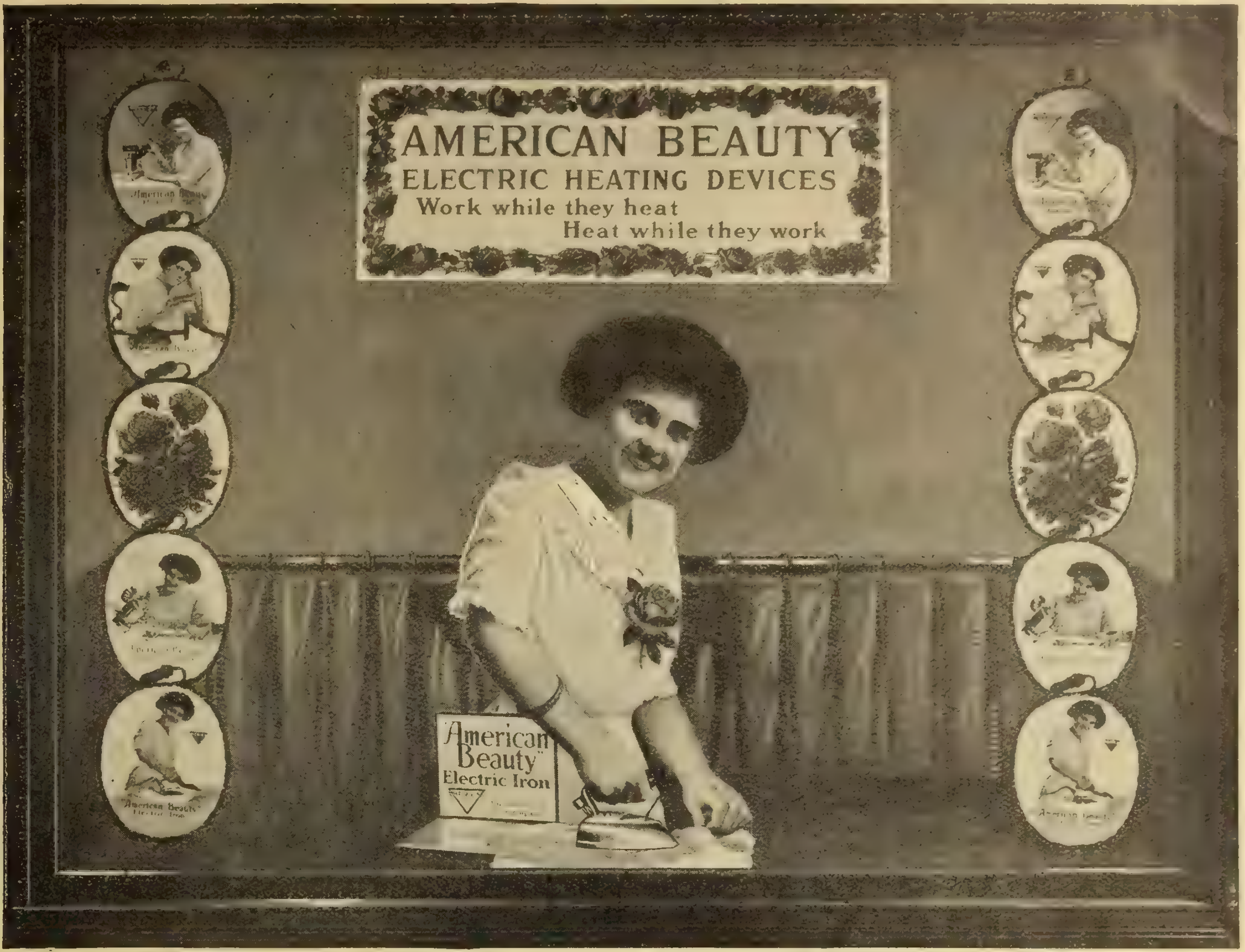
Northern Lights comprise Wire Drawn Mazda Filament, Carbon and Metalized Carbon Filament Lamps. The Mazda types are made in all the commercial voltages and Watts consumption. They come neatly packed in attractive carton boxes, are sold under a liberal guarantee and are carried in all sizes from 15 to 500 Watt. "Northern Light" etched on the glass is the guarantee of quality.

Now is the time to stock up

THE Northern-Electric
AND MANUFACTURING CO. LIMITED

Manufacturer and Distributor of Telephone and Fire Alarm Apparatus and Electrical Supplies for every possible need.

Montreal Halifax Toronto Winnipeg Regina Calgary Edmonton Vancouver



Dealers - Attention

Here is a Window Display which will make your Window Earn Money for You!

This is an unusually effective display in natural colors. It will attract those who pass your store and bring them in. It will make them "want the goods."

This Display Material will equip you to make a variety of displays. With it you can make a small display in a small window or you can enlarge it to a very large display.

These are expensive but will be furnished without charge *if you will use them.*

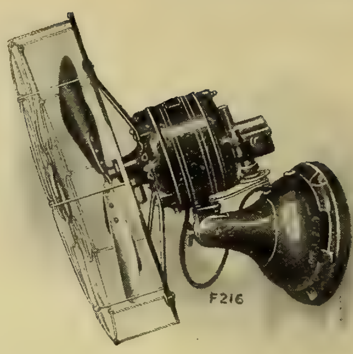
Write our nearest House to-day.

THE Northern-Electric AND MANUFACTURING CO. LIMITED

Manufacturer and Distributor of Telephone and Fire Alarm
Apparatus and Electrical Supplies for every possible need.

Montreal Halifax Toronto Winnipeg Regina Calgary Edmonton Vancouver

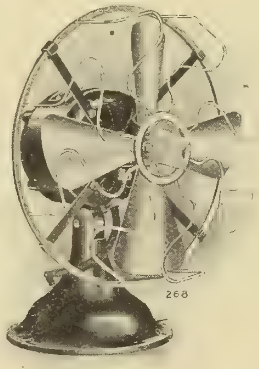
How We Help You Sell "Standard" Fans



Model 11 Gear Type Oscillator in Wall Bracket Position.

We're going ahead with the most vigorous, wide-spread national advertising campaign to create more business for "STANDARD" Dealers this season than we've ever attempted. Keep your eye on the *Saturday Evening Post.*

Robbins & Myers "STANDARD" Fans



New 8-inch Induction Type in Desk Position.

have set the pace for 18 years. We concentrate on small Motors and Electric Fans, and by giving our undivided effort to these two devices, the name "STANDARD" is so well-known for reliability, economy and efficiency that they are the most easily sold articles of their kind. Write for any particulars that you may not have.

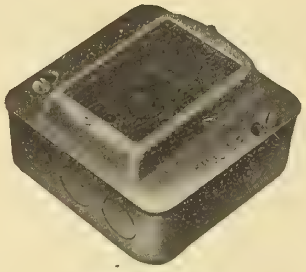
THE ROBBINS & MYERS CO.
Springfield, Ohio

We also manufacture a complete line of small D. C. and A. C. Motors for all purposes.

"GOOD STUFF"

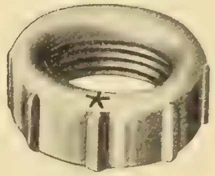
GET A SAMPLE

AND AT OUR EQUAL PRICES YOU WON'T WANT ANY OTHER MAKE.



"Steel City" Outlet Boxes

You cannot afford to use a box requiring more labor to install. Clean-Cut Knockouts. Sherardized or Enameled Finish. Packed in Heavy Paper Cartons and Wood Cases.



"Star" Bushings

The kind the wireman likes. The name is famous and the bushings have been favorites since they were first manufactured.

Also "Fullman" Floor Outlets, "Universal" Insulator Supports, Fixture Stems, "Superior" Fish Wire, Conduit Benders, Beam Straps.

Write for Catalogs

STEEL CITY ELECTRIC CO., Pittsburgh, Pa.

EVER HEARD OF THE

Canadian Carbon Co., Limited?

Dealt with them and found them reliable? Send them your orders and they'll

HELP YOU TO MAKE MONEY.

"XCELL" Dry Batteries — All kinds of Dry Batteries
Flashlights of every description
Arc Light Carbons
Flaming Arc Carbons
Spark Plugs
Miniature Lamps

Everything with "Nine Lives" spells quality.

Trade Mark

96 West King Street - TORONTO

One of 28

AN Underwood is worth what you pay for it. It may be one at $130 or at $1500.

There are 28 models—adaptable to every requirement of writing, adding, subtracting, computing; and system work of all kinds.

As every record in competition shows, the Underwood increases the efficiency of the operator at least 20% over any other typewriter.

Even a correspondence Underwood will save its cost almost in the first year.

An Underwood is an advertisement for the man who owns it.

United Typewriter Company Limited

All Canadian Cities

RELIABLE MANUFACTURERS STAND BEHIND THEIR PRODUCTS

The Tungstolier Company of Canada Limited

absolutely guarantee

Design, Workmanship, Material and Finish

The combination of the above mentioned
is perfect lighting fixtures, namely,
TUNGSTOLIERS

To protect the Trade all Tungstoliers
are marked so that you may identify them

The Tungstolier Company

of Canada, Limited

Head Office: 212 King St. West TORONTO, ONT.

Operating Economies

Can be effected in many branches of Railway Work by using Aluminium.

A few applications of the metal are :—

Side-Panels
Ceilings
Hand-Holds
Strap-Rails
Brackets
Grab-Rails
Door-Handles
Window-Catches
Hat-Hooks
Etc. Etc.

One of the London District Railway Cars Fitted Out in Aluminium

Take a look round your cars. Wouldn't they look better fitted out with light untarnishable metal and frosted ceilings? Aluminium panels take paint better than steel or wood, and reduce the useless ton-miles.

The British Aluminium Co., Ltd.

LONDON, ENG.

Canadian Head Office—**60 W. Front St., Toronto, Canada**

—National Electric Code Standard—

"SHAWMUT"

ENCLOSED FUSES AND FITTINGS

The Fuse with the Black Tube and Copper Ends

"BOSTON" Cable Clips
"CUSHING" Stage Pockets and Plugs
"SHAWMUT" Ground Clamps
"SHAWMUT" Transformer Cutouts

THE CONDIT ELECTRICAL MANUFACTURING CO.
BOSTON, MASS.

If your Jobber does not handle this material
write for Catalogues and Prices to

Frank G. Scofield, Sales Rep.
Lumsden Bldg.,
Toronto, Ont.

ATTENTION!

PATRONS of the ELECTRICAL CONVENTION

Before Placing
Accident Insurance
on your
Electric Truck
or
Automobile

For
Specialists
in
Boiler Inspection
and
Insurance

COMMUNICATE WITH

The
General Accident Assurance Company of Canada

The
Canadian Casualty and Boiler Insurance Company

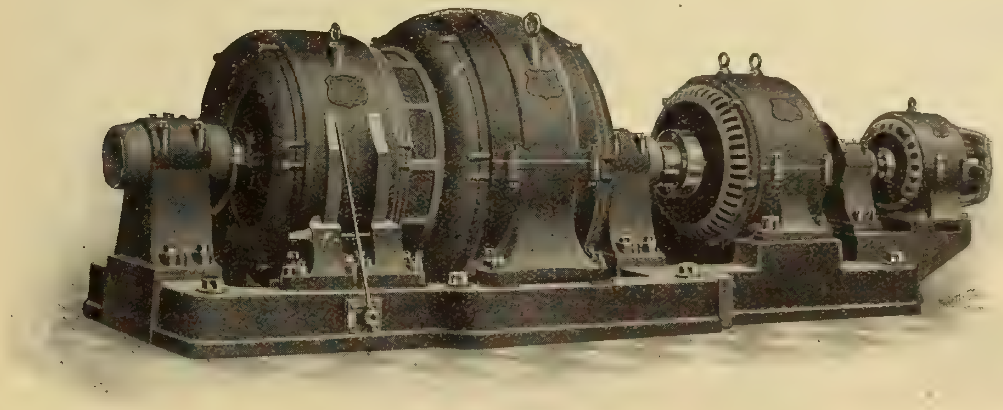
Head Office: TORONTO
J. J. DURANCE, Manager

Curve Drawing Instruments

The "Elliott" portable voltmeter shows the style of instrument. It is really portable, is accurate, carries a week's supply of ink and gives a continuous chart. We can supply ammeters and wattmeters in similar style of case.

The electrical parts are sturdy and will stand hard usage without damage and the clock is an accurate timekeeper. Instruments can be fitted with a double clock speed of say 1″ per hour and per minute or 1″ and 3″ per hour etc., the change of speed being made by the simple movement of a lever.

For tests on consumer's premises or for factory testing of motors this instrument is unique and the price is right.



750 K V A Synchronous Motor Driving 300 K V A Alternator and 200 K W Traction Generator.

The
"Lancashire" Ball Bearing Induction Motor

Has no equal as an efficient, well built and reliable source of power.

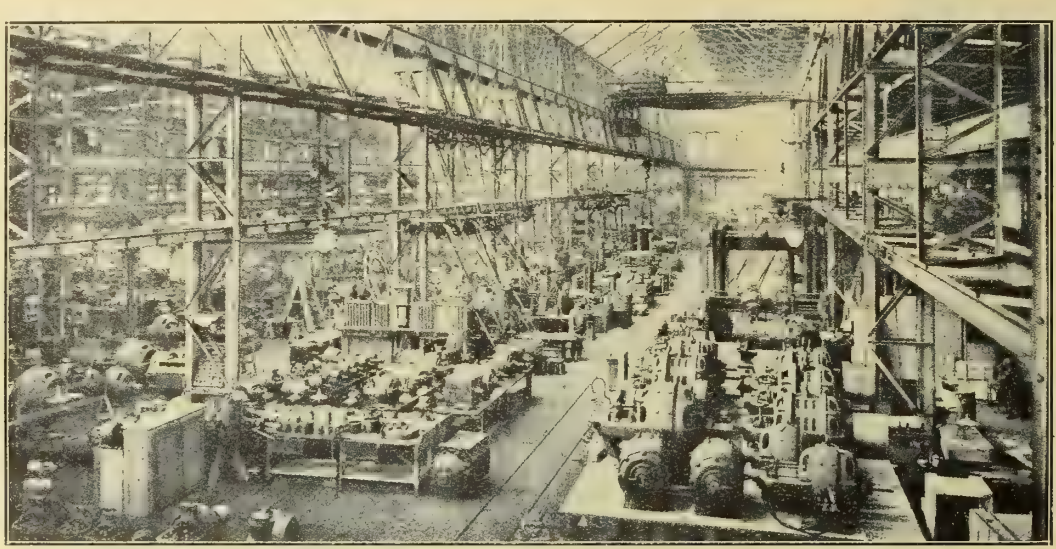
The Lancashire Dynamo & Motor Co.
of Canada, Limited

Montreal **Toronto**

THE CANADIAN UNION ELECTRIC CO., LTD.

Manufacturers of

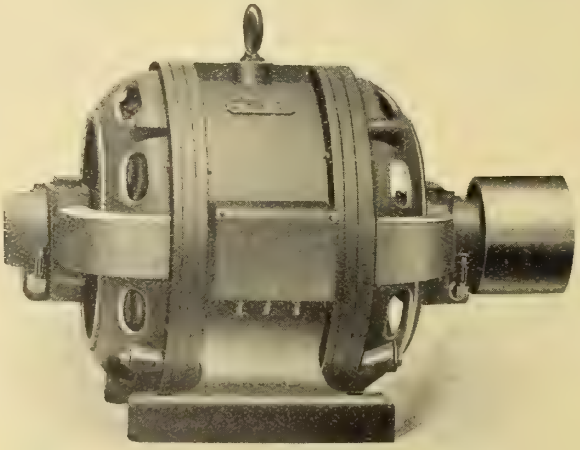
DYNAMOS MOTORS ALTERNATORS
ARC LAMPS ETC.



A photographic view of one bay in the Factory showing Union Dynamos and Motors in process of manufacture

Stock carried at MONTREAL, TORONTO, WINNIPEG and VANCOUVER

High Efficiency
Great Overload Capacity
Ample Ventilation



Pattern H.D. Squirrel Cage Motor

Sound Mechanical Construction and Smooth Running

122 Wellington St., West
TORONTO, ONT.

9 St. Nicholas Street
MONTREAL, P.Q.

The Mainer Electric Co., Limited,

61-3 Albert Street
WINNIPEG, MAN.

Plant of Standard Underground Cable Co., of Canada, Limited, Hamilton, Ont.

The Price of Enduring Success

IT has been said that the first essential in winning success is "to deserve it." We believe that the way to deserve enduring success in our business is to render untiring service. Therefore, we decided to devote this space to telling what we have done and are doing to ***deserve*** your patronage,—namely :

Built Factories at Hamilton, Ont., which are the most modern and complete of their kind and which enable us to control every step in our manufacturing processes and thus guarantee uniform quality throughout our products.

Manufacturing a Complete Line of Electric Wires and Cables for all classes of service, also Cable Terminals, Cable Junction Boxes and other Accessories.

Maintaining Branch Offices, with experienced salesmen, at points most convenient to our customers so that their requirements may be supplied with the least possible delay.

Maintaining Large Stocks of raw and finished materials, thus insuring prompt filling of orders.

Maintaining a High Quality in everything we manufacture to the end that our customers may receive, not the ***cheapest*** products obtainable, but the most ***economical.*** That is products which, when durability and low maintenance cost are considered, are in the end far more profitable than those commonly called "cheap."

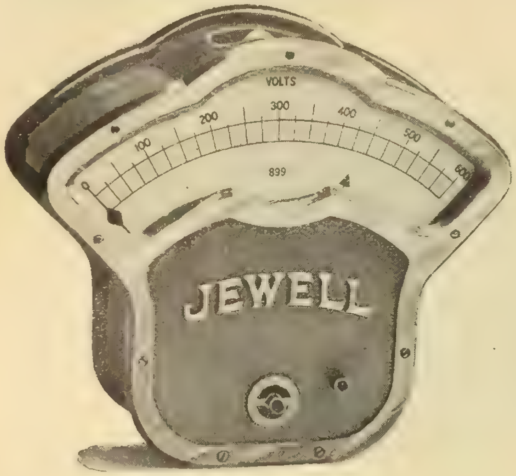
We have an attractive booklet giving full information about our various products and about "STANDARD SERVICE" which will be of value to you in your files. A request to our nearest office will bring your copy.

Standard Underground Cable Co., of Canada, Limited

Hamilton, Ont.

Winnipeg, Man.
Seattle, Wash.

Montreal, Que.
Boston, Mass.



Jewell Illuminated Dial

The Jewell voltmeter is made in D. C. and A. C. and is equipped with the Jewell Illuminated Dial. Behind the opalescent glass dial, in a chamber outside the instrument is mounted a 16 candle-power incandescent bulb.

The Jewell voltmeter is furnished in either black enamel and copper front or with dull black finish.

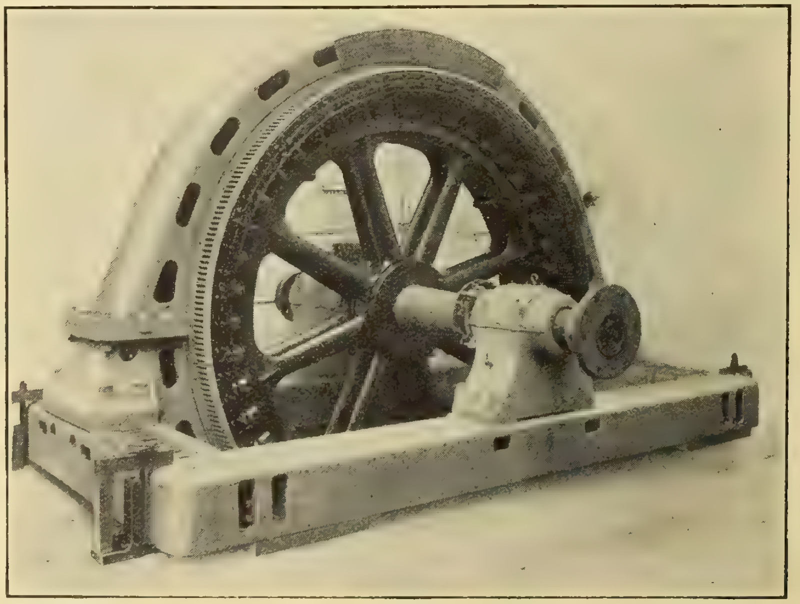
Let us quote on your meter requirements

MARSHALL - DAVIS
—LIMITED—
ELECTRICAL APPLIANCES
DUNNVILLE, - ONTARIO

VICKERS LIMITED

Patent Automatic Reversing Drive for Planing Machines

Complete Equipments for the electrical lighting and driving of machine shops, factories, etc.



K. W., 6600-volt, 164 R. P. M. 3-Phase Generator for the City of Winnipeg. Five Generators have been supplied

Turbo Generators

Motors of all types

Motor Generators

Rotary Convertors

Head Office for Canada: Lewis Building, Montreal
Mr. J. F. I. Thomas (Representative)

Works:
River Don Works, Sheffield, England

We specialize as follows:

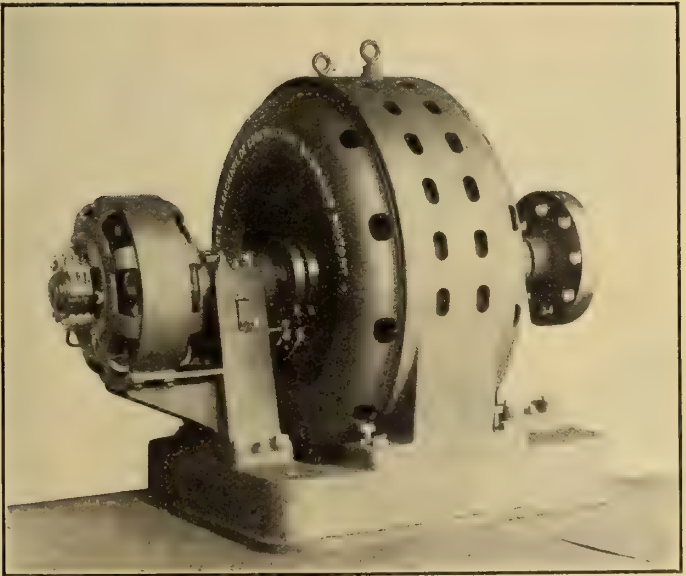
Street Railway Supplies
Pole Line Material
Hot Point Heating Apparatus
Tungsten and Carbon Lamps
Lighting Fixtures
Wires and Cables
Arc Lamps and Carbons
General Supplies of all kinds
Car Heaters and Trucks
Headlights and Panel Boards
Telephones and Transformers

Let us quote you prices. It will save you money.

Dawson & Company, Limited, Winnipeg
Montreal

Engineering Works of Canada, Limited

Head Offices: NEW Birks Building, MONTREAL, QUE.



A. C. Generator with Directly Connected Exciter.

Descriptive Pamphlet of our Generators mailed upon request

Builders under the patents of the

Societe Alsacienne

Belfort, (FRANCE) Mulhouse, Grafenstaden (GERMANY)

ESTABLISHED 1826

Power Plants, Rolling Mills, Mining and Hoisting Machinery

STIGLER'S

Patented Passenger and Freight

ELEVATORS

Duncan Quality

Duncan Quality

Guaranteed by this
Trade Mark

TRADE DUNCAN MARK

Duncan Quality

Sign Receptacles
for
Electrical Sign Makers

No. 988

No. 988 is a two piece sign receptacle which is now furnished with Mica, insulating point of contact from lamp shells. A thoroughly reliable receptacle of "Duncan Quality."

No. 29

No. 29 is a **self holding** receptacle, strongly made and sheet metal holder. It requires only a plain **round** hole in sign and thus it is more easily and quickly adjusted. Another point is the fact that the making of plain **round** holes is easier on your punches and makes them last longer than if the hole were notched.

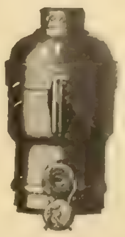
ORDER THROUGH YOUR JOBBER

The Duncan Electrical Co., Limited

Montreal

Makers of "Duncan Quality" Electrical Supplies

"This sealable Shurlok makes lamp thieves think twice"



"The above illustration shows P&S 10042l with the Shurlok attachment and with sealing holes. The illustration shows the sealing wire and seal in place. We do not supply the wire or lead seals.

and then decide not to try to remove lamps from sockets so protected.

Perhaps you Central Stations who have rental cluster service want even greater protection than is given by the ordinary form of Shurlok.

The illustration herewith shows how it is possible for you to attach your private seal, which will show at a glance whether or not anyone has attempted to tamper with the lock even though they have been unsuccessful.

There will be no additional charge for supplying Shurlok sockets with these holes for sealing, but they will not be so supplied unless so orderd.

In ordering Shurlok sockets of this description, add the words "with sealing holes."

Send for Free Booklet

"FOR SALE BY ALL JOBBERS"

Carried in Stock by :

John Starr, Son & Co., Limited	Halifax
St. John Railway Company	St. John, N. B.
Mechanics Supply Company, Limited	Quebec
Dawson & Company, Limited	Montreal
Central Electric & School Supply Company	Toronto
Mainer Electric Company	Winnipeg
Dawson & Company	Winnipeg
General Supplies Limited	Calgary, Alta.
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Pass & Seymour, Inc.

Main Office and Works:

Solvay, New York, U. S. A.

New York City
178 Fulton Street

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Rialto Building

Chicago, 700 West Jackson Blvd.

PASS & SEYMOUR, INC., Solvay, N. Y.
Please send free copy Shurlok booklet and Catalog 20.
Name..
Address..
City..
State..
Coupon No. 111

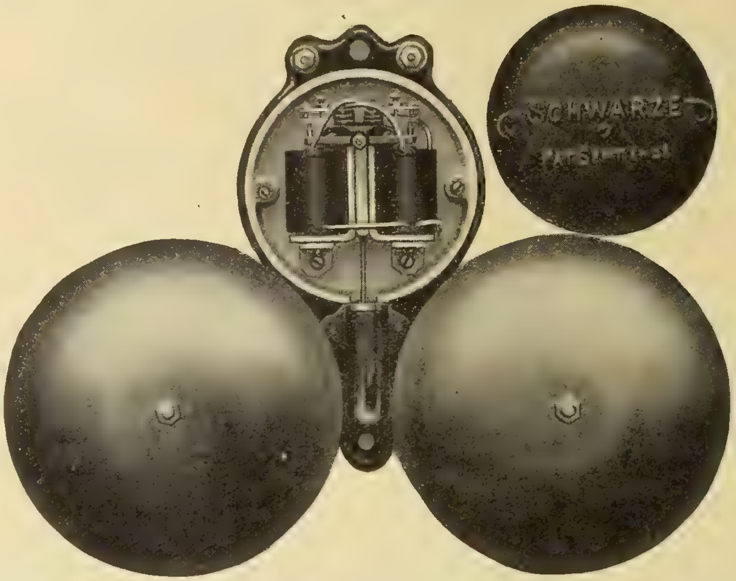
SCHWARZE ELECTRIC BELLS

Permanent Efficiency Plus Durability

No. 22 shown herewith is for use on Battery or high tension, direct current circuits.

The bell is made entirely insulated from the frame; is fully approved by the underwriters; is remarkable for its quick response and instant stopping, and is, like all Schwarze Bells absolutely guaranteed.

Our catalog tells the whole story.



We make an electric bell for every possible need such as—railroads — mines — industrial works, etc.

We make them of the best material we can buy.

They are of a new and greatly improved design and are used and endorsed by railroads in both U.S. and Can.

Our catalog tells the whole story—types—sizes—prices, etc.

Your name on a postal will bring it. Send today

SCHWARZE ELECTRIC COMPANY
ADRIAN - MICH. - U. S. A.

Norton Telephone Co., Toronto, Ont. - *Canadian Agents*

DOSSERT CONNECTORS for BUS BAR WORK

Where tubing and solid bus are to be tapped they are invaluable.

MINIMIZE HEAT LOSSES

by connecting cables to your large machines
for generating and converting current with

DOSSERT TERMINAL LUGS

Troubles due to faulty joints are eliminated, while costs are reduced by the facility and simplicity of their installation.

Engineers who Design, Construct and Operate the most important Power Generating Stations unite in commending the good results obtained from the use of Dossert Connectors.

DOSSERT & COMPANY
H. B. LOGAN, President
242 West 41st Street NEW YORK
General Representative for Canada: IRVING H. SMITH, 809 Unity Building, Montreal

PHILLIPS

Electrical Wires and Cables

Bare and Insulated Copper Wires and Cables.

Bare and Insulated Electric Wire and Cables for Aerial and Underground Use.

Railway Feeder and Trolley Wire.

Weatherproof Magnet and Rubber Covered Wires and Cables.

Incandescent and Flexible Cords.

Telephone, Telegraph, Lighting, Power and Street Railway Wires, Cables and Equipment.

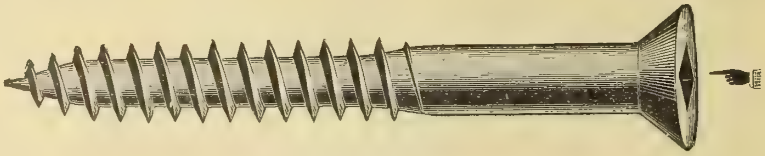
Eugene F. Phillips Electrical Works, Limited

MONTREAL - - CANADA

Branches: HALIFAX TORONTO WINNIPEG VANCOUVER

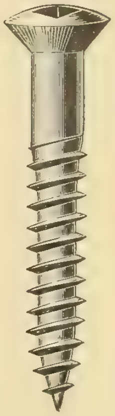
ROBERTSON SOCKET HEAD

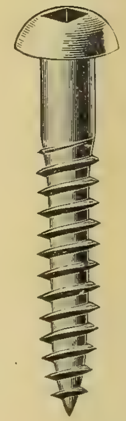
WOOD SCREWS



PAT. FEB. 2, 1909

SEE
THAT
SQUARE
HOLE





THIS IS A REAL WOOD SCREW

It is driven by a specially designed screw driver which fits snugly into the square hole in the head and there it stays until the work is done. This is the only wood screw of its type on the market and is especially adapted to all work connected with electrical wiring, fixtures, etc.

TRY IT

Place the screw on the driver, then you may reach out at arms length and drive it with one hand. For overhead work, or work between joists or under flooring it is invaluable. Saves time, labor and material. We make the drivers in all suitable styles.

Drivers Free With First Order

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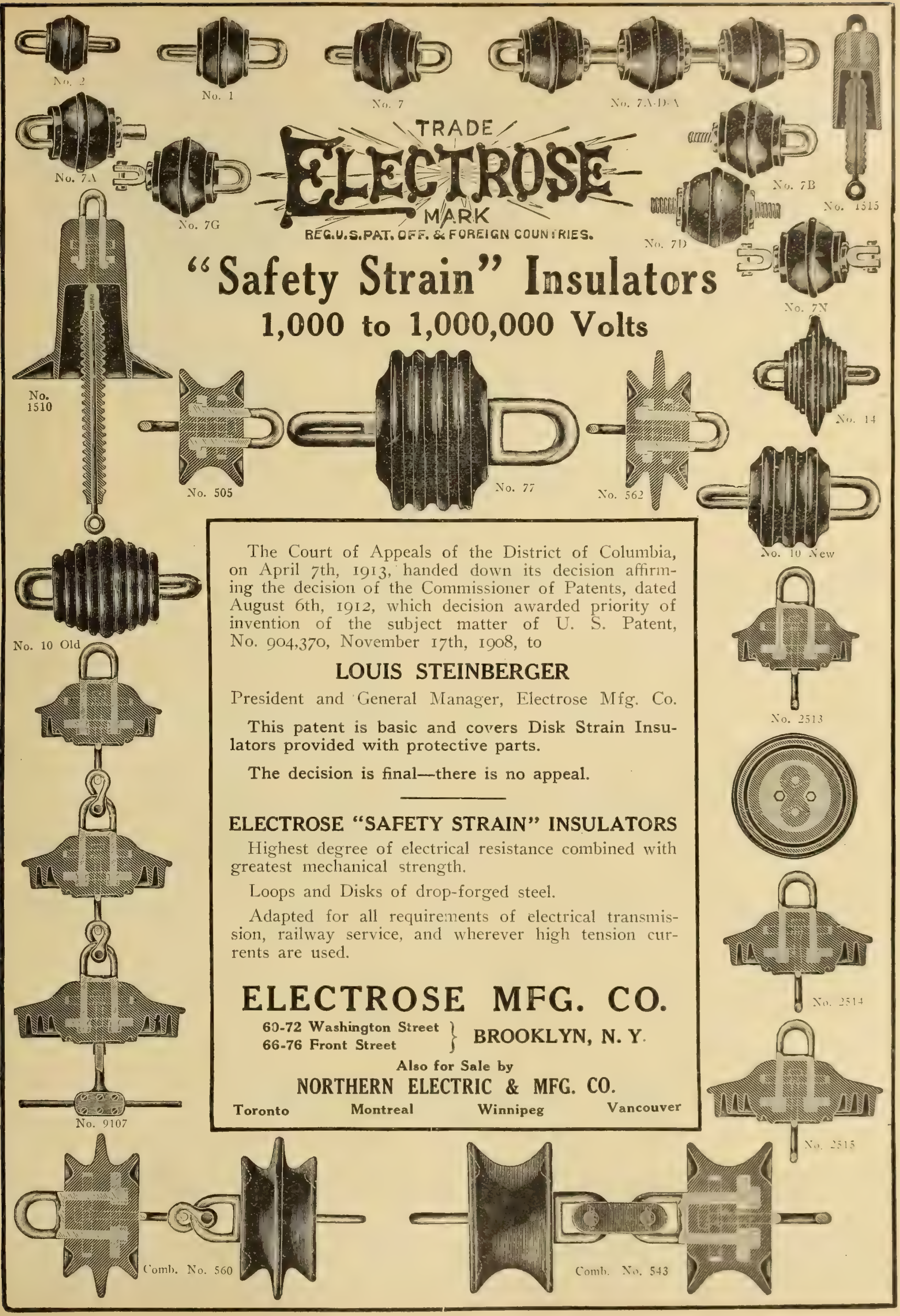

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"Safety Strain" Insulators

1,000 to 1,000,000 Volts

The Court of Appeals of the District of Columbia, on April 7th, 1913, handed down its decision affirming the decision of the Commissioner of Patents, dated August 6th, 1912, which decision awarded priority of invention of the subject matter of U. S. Patent, No. 904,370, November 17th, 1908, to

LOUIS STEINBERGER

President and General Manager, Electrose Mfg. Co.

This patent is basic and covers Disk Strain Insulators provided with protective parts.

The decision is final—there is no appeal.

ELECTROSE "SAFETY STRAIN" INSULATORS

Highest degree of electrical resistance combined with greatest mechanical strength.

Loops and Disks of drop-forged steel.

Adapted for all requirements of electrical transmission, railway service, and wherever high tension currents are used.

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"Lest You Forget"

that the DOMINION ELECTRIC CO. makes a very fine line of Carbon lamps and sells them at close competitive prices. Why buy European lamps, such as are sold by some jobbing houses and manufacturers agents, when you can purchase Canada made lamps, our lamps, at magnetic prices?

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Special inducements to the wholesale trade.

When ordering kindly state your voltage, it saves delay.

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How would you like to have a Gross Annual Income of $8,000 to $15,000 from a total investment in Ice Plant of $21,000.

Total Investment in Ice Plant, $21,600
Gross Annual Income $8,000 to $15,000

—from 37 to 70 per cent on the investment. Wouldn't an income like that put a hole in the cost of your regular Central Station output? You can get it, at practically no extra labor cost, if you install

CARBONDALE ICE MACHINERY

which enables you to utilize your exhaust steam for the manufacture of a highly-profitable by-product.

You will find the sales problem practically non-existent, because the local ice-dealers know the demand for pure, clear, hygienic artificial ice, and will gladly buy your product at a good price.

Our booklet, "By-Product Ice" contains much information that is both interesting and technically correct— copy will be sent upon request.

In the Northern States the ice-making business is in a **measure dependent** upon the length and severity of the winter. Nevertheless certain plants in localities where the supply of natural ice is ample are receiving good returns on ice-plant investments. A central station in northern Illinois serving a population of 6,347 inhabitants operates an ice plant during the summer months, usually about six months of the year. The maximum output of the plant is 20 tons a day and the total has averaged 2,000 tons per season. The plant employs absorption apparatus and distilled water and has been in operation for four years. The total investment in the ice plant was $21,600, and the gross income from the ice business has been between $8,000 and $15,000 per year. From Electrical World, March 1, 1913.

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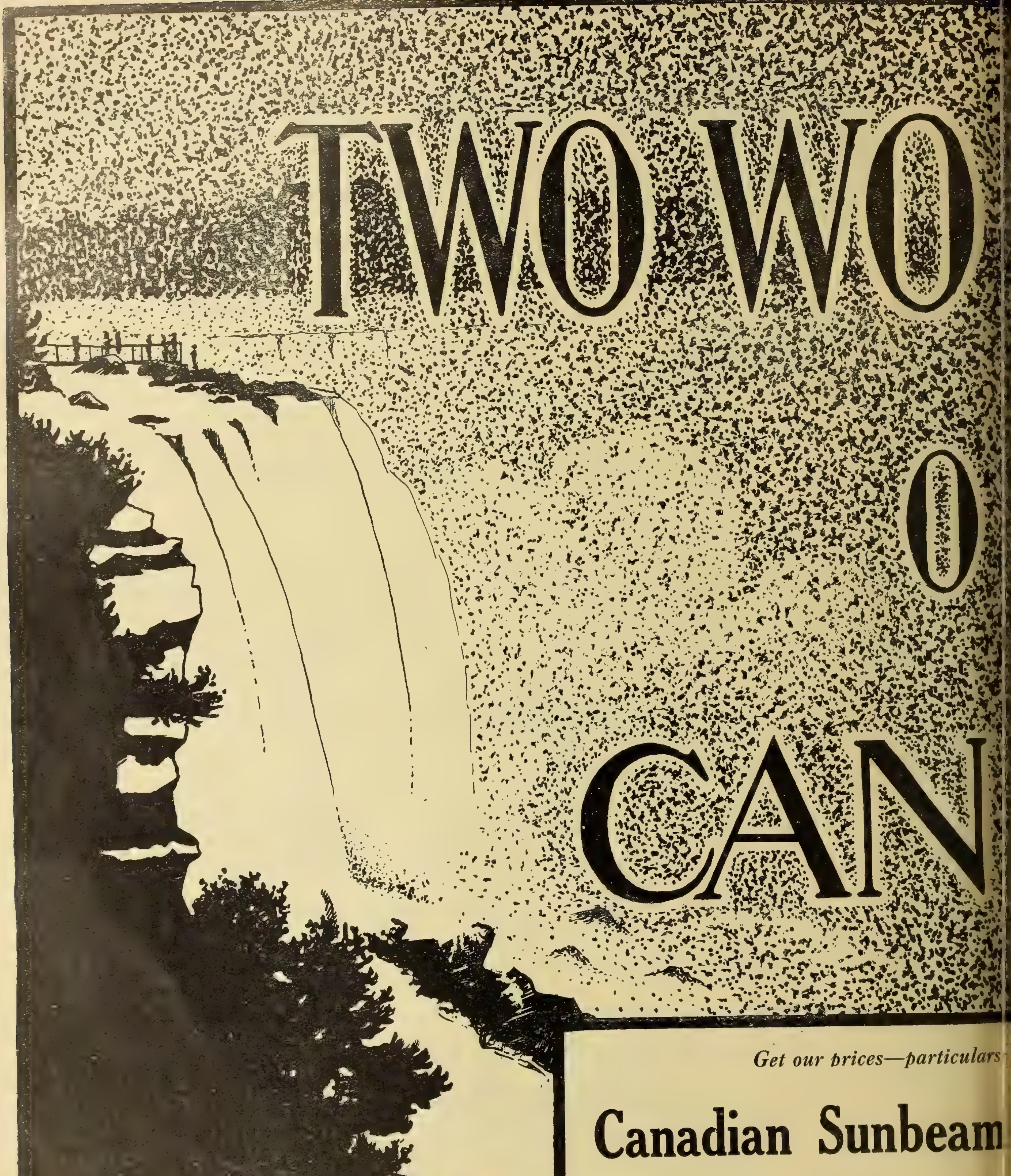

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MOST of the interurban railways of the United States have long since adopted Ohmer Fare Registers as a standard. This fact has led some to believe that the Ohmer "idea" was adapted only to the long distance systems, and could not be carried out so successfully in city service.

The great city systems at Denver, Detroit, Syracuse and Toledo have adopted the Time Feature Ohmer Register for city service, and many other large city railways are using either the Time Feature machine or one of our other types adapted to meet local conditions.

These registers are installed by our own men. We also send our "System" experts to serve in an advisory capacity until the success of the installation is assured.

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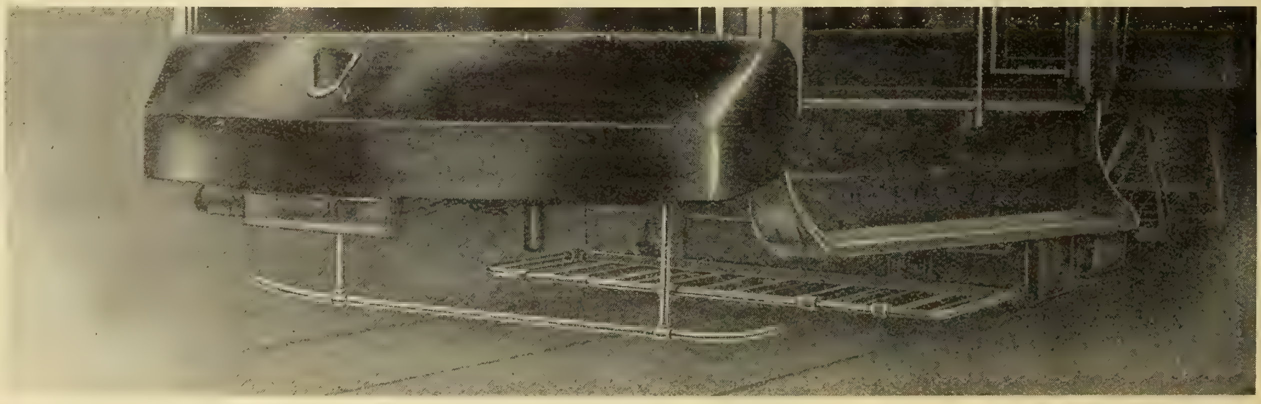
FOR STREET CARS



Arrangements for the manufacture of these wheel guards have been made with the Schofield-Holden Machine Co., Ltd., Toronto, Canada, under Canadian Patent No. 131,381 Dated Feb. 28, 1911 and can be seen in operation at their factory 2 Carlaw Ave., Toronto.
These wheel guards are attached to the truck of the car and are absolutely automatic, always follow the rail whether on curve or straight track.

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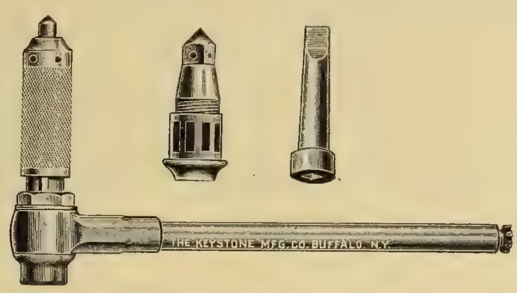
Consists of Ratchet for Taper Shank Twist Drills, Sleeve for Square Shank Drills, and Short Boiler Socket for Square Shank Drills, (Sockets Interchangeable)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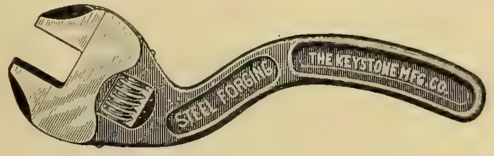

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We also make a Pipe Wrench in this style

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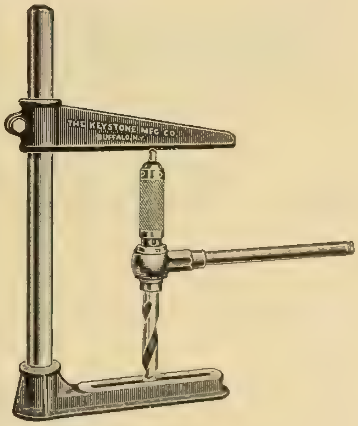
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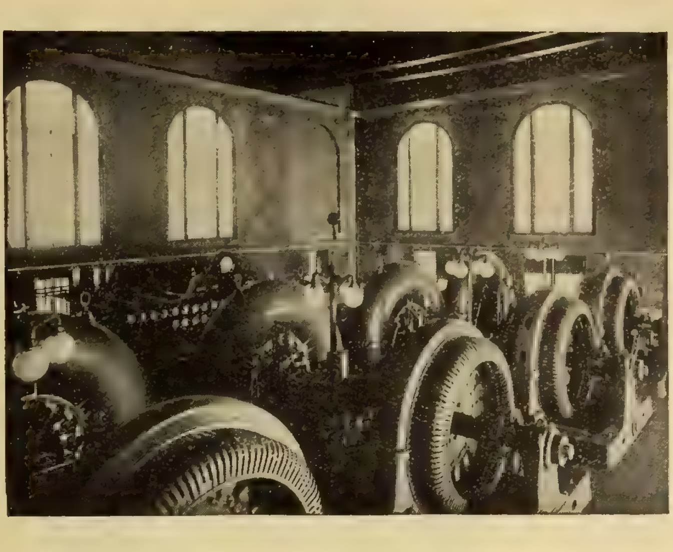

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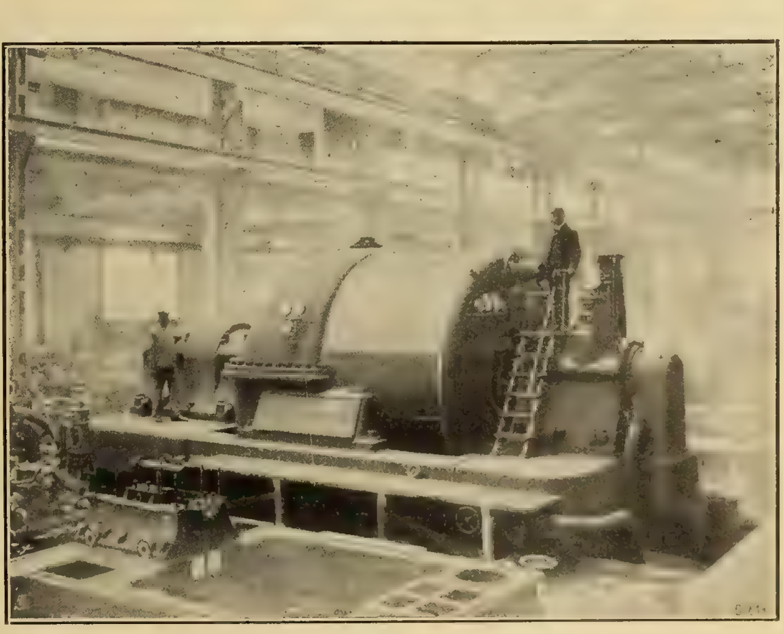

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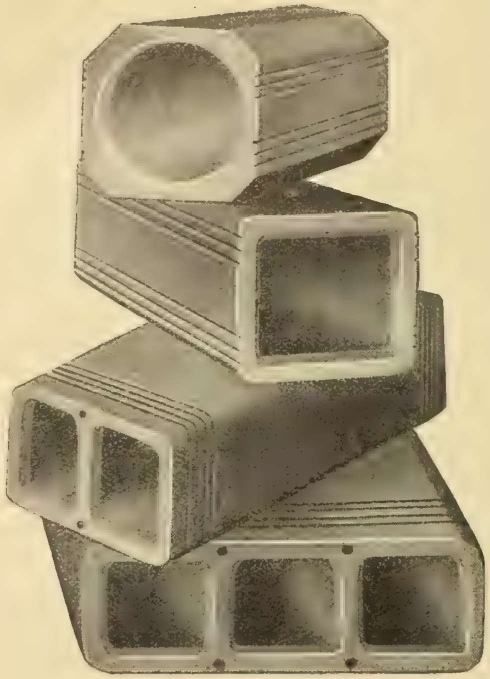

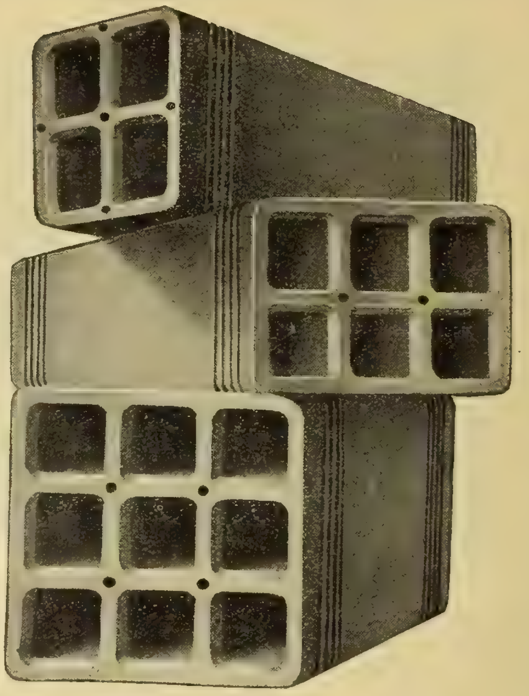

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Used in filling junction boxes, conduits, pot-heads or any undergound system from central or sub-station where insulation and water-proof qualities are essential. Acid proof and waterproof. Plastic at zero temperature. Melting point to suit specifications.

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The standard insulating compound for armatures and field coils. Absolutely impervious to moisture. Made of black paraffine wax rendered permanently plastic by a process known only to this company. Is plastic whenever the machine is in operation. Without a trace of acid. Oil cannot affect the insulation. It has stood most severe tests in actual service for over 17 years.

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Quality — in material and workmanship—is the chief characteristic of "Packard" Mazda Lamp.

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We have at all times a large supply of tungsten and carbon lamps, from which we can make prompt shipments, at

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Type K Metal Case

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No instrument in your electric service plays a more important part than your meters, for upon them depends, to a large degree, your profits or losses. The inaccuracy of these instruments or derangement of their fine mechanical construction can have but two effects—a loss of current and dollars to you or the dissatisfaction of your customers. Neither of these conditions must prevail.

Realizing the importance of these instruments, the Packard Electric Co. has exercised great care in designing and manufacturing types of meters which will not only insure accurate registration but also continuous service.

Why risk the loss of current or dissatisfaction of your customers by installing inferior instruments?

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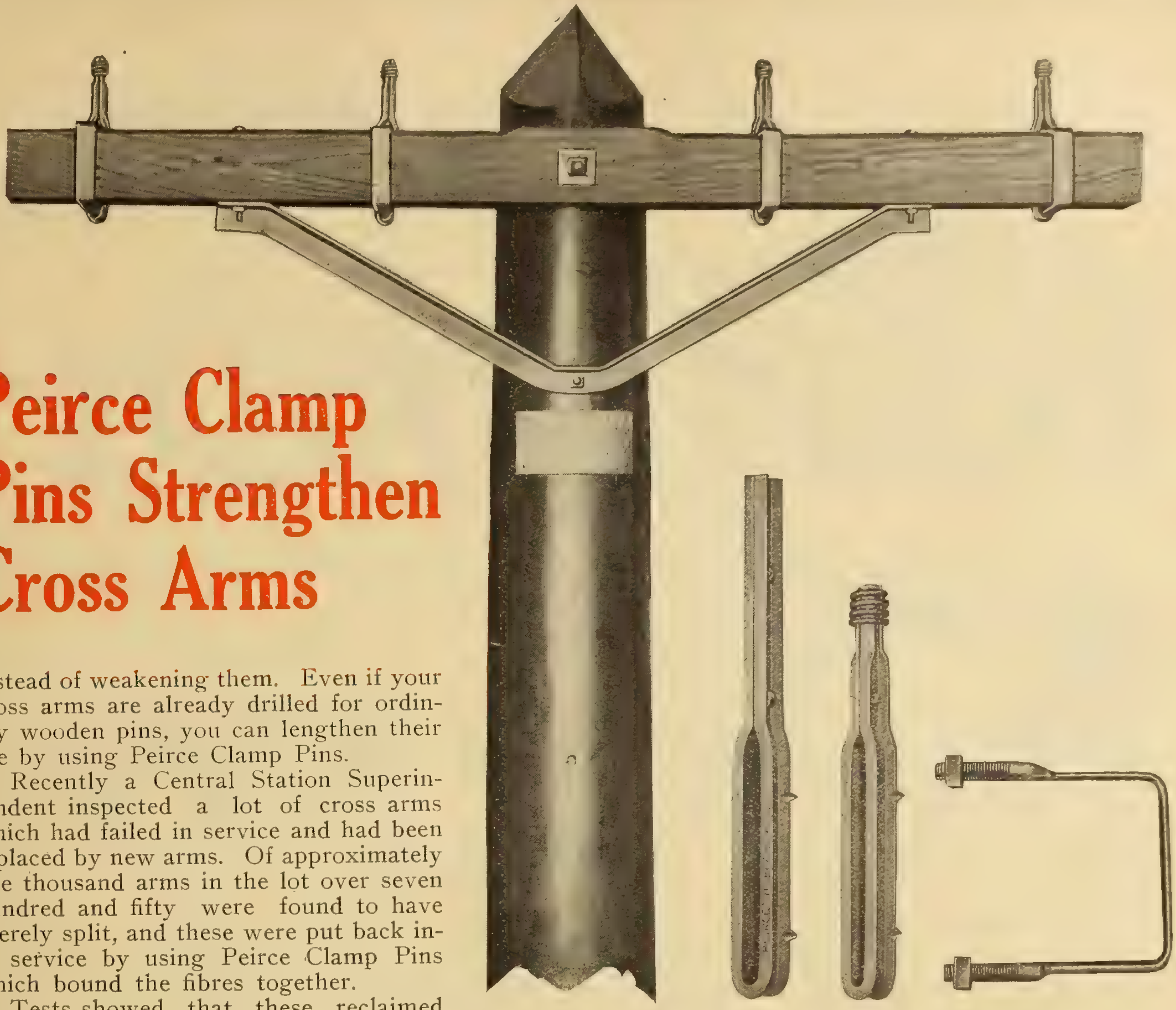

Peirce Clamp Pins Strengthen Cross Arms

instead of weakening them. Even if your cross arms are already drilled for ordinary wooden pins, you can lengthen their life by using Peirce Clamp Pins.

Recently a Central Station Superintendent inspected a lot of cross arms which had failed in service and had been replaced by new arms. Of approximately one thousand arms in the lot over seven hundred and fifty were found to have merely split, and these were put back into service by using Peirce Clamp Pins which bound the fibres together.

Tests showed that these reclaimed arms when so equipped were stronger than new arms with wood pins.

The pins are rolled out of open hearth steel, properly designed for the exacting demands of modern service. The heavy coat of hot galvanizing gives full protection against rust.

Isn't it perfectly evident that, whereas a cross arm is seriously weakened by drilling holes for ordinary pins, it is bound to be stronger when clamped with steel bands such as those used in installing Peirce Clamp Pins?

Remember that a locust pin loses 40 per cent of its strength the first year, while the Peirce Clamp Pin lasts forever, and will carry an 800 lb. strain without deflection. All Peirce Clamp Pins are equipped with

The Peirce Spring Thread

which allows for expansion, contraction or inequality of bore, yet holds the insulator securely at all times.

In hot weather, it elongates and creeps further up in the insulator thread, preventing destructive pressure on the glass—in cold weather it still keeps closely in contact, and the insulator can't wobble.

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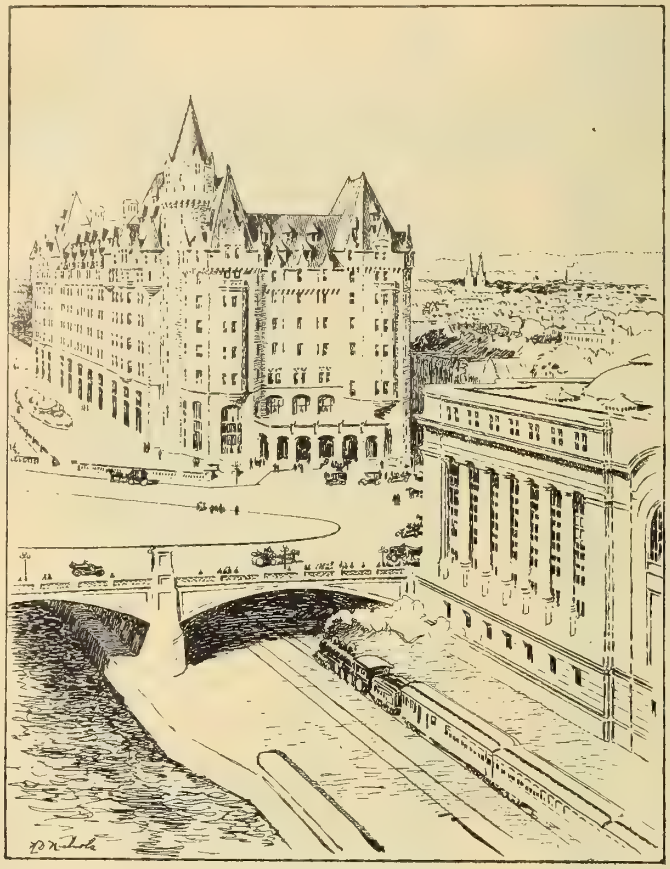
Peirce Specialties and Hubbard Line Hardware are carried by Canadian Electrical Jobbers.

The Hardware MAKES the Line, Hubbard Makes THE Hardware

Hubbard and Company, Pittsburgh, U.S.A.



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Rubber Insulated Wire

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Our Wires and Cables are included in the list of Electrical Fittings, examined and tested under the requirements of the National Board of Fire Underwriters, by the Underwriters Laboratories, and approved for use. Every coil is subject to test and acceptance by their inspectors at our factory.

We have established offices at 611 C.P.R. Building, **Toronto,** and at 902 Electric Railway Chambers, **Winnipeg,** for the benefit of our customers in Ontario, Manitoba and Saskatchewan. Write to the nearest office for information and prices.

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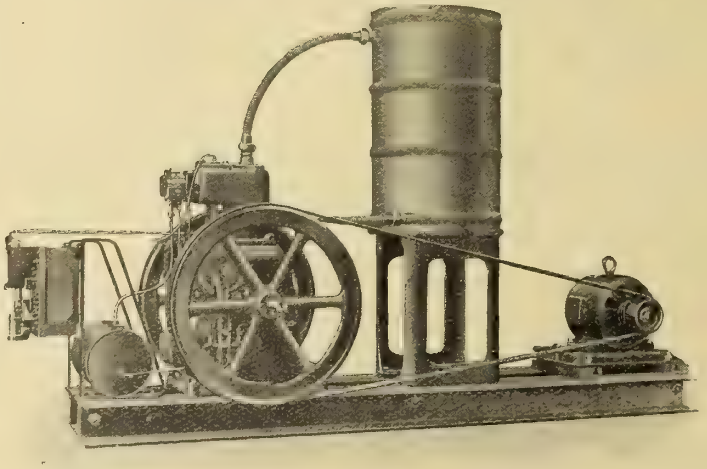

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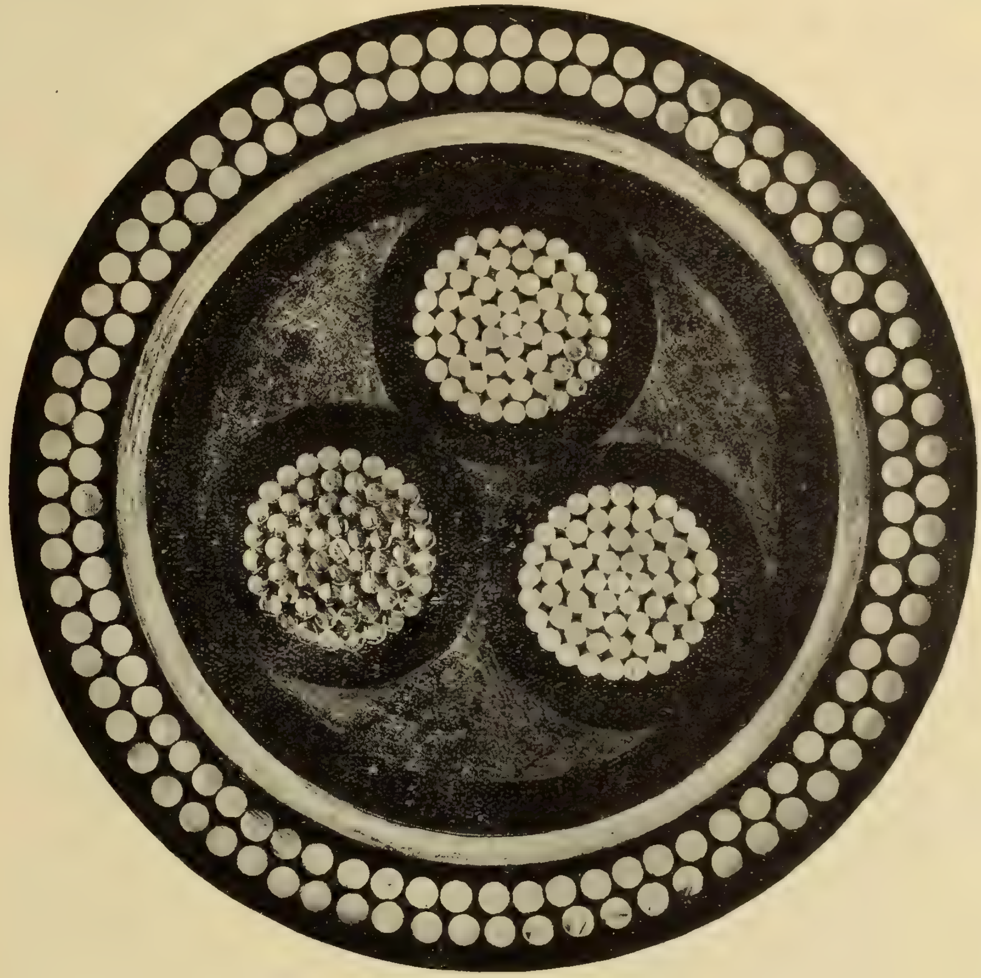

Illustration actual size of cable

500,000 C.M., Three-Conductor, Paper-Insulated, Lead-Covered, Double-Steel-Wire Armoured Cable, supplied to The Toronto Power Company to the specification of The Pearson Engineering Corporation of New York City.

Working Pressure 12,000 Volts

Sole Canadian Representatives:

Canadian British Insulated

Company, Limited

Montreal

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We take this opportunity of announcing that we have acquired the rights, and are prepared to supply in Canada and Newfoundland the manufactures of the well known firm of

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Works—**Baden, Mannheim, Paris, Milan, Christiana, Vienna**

Leading Specialties

- Steam Turbines, with Condensing Plants.
- Turbo Alternators and Direct Current Turbo Generators.
- Turbo Blowers and Turbo Compressors.
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- Electrical Mining Machinery.
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- Special Motors for the Paper-Making and Textile Industries.
- Phase Compensators or Advancers.
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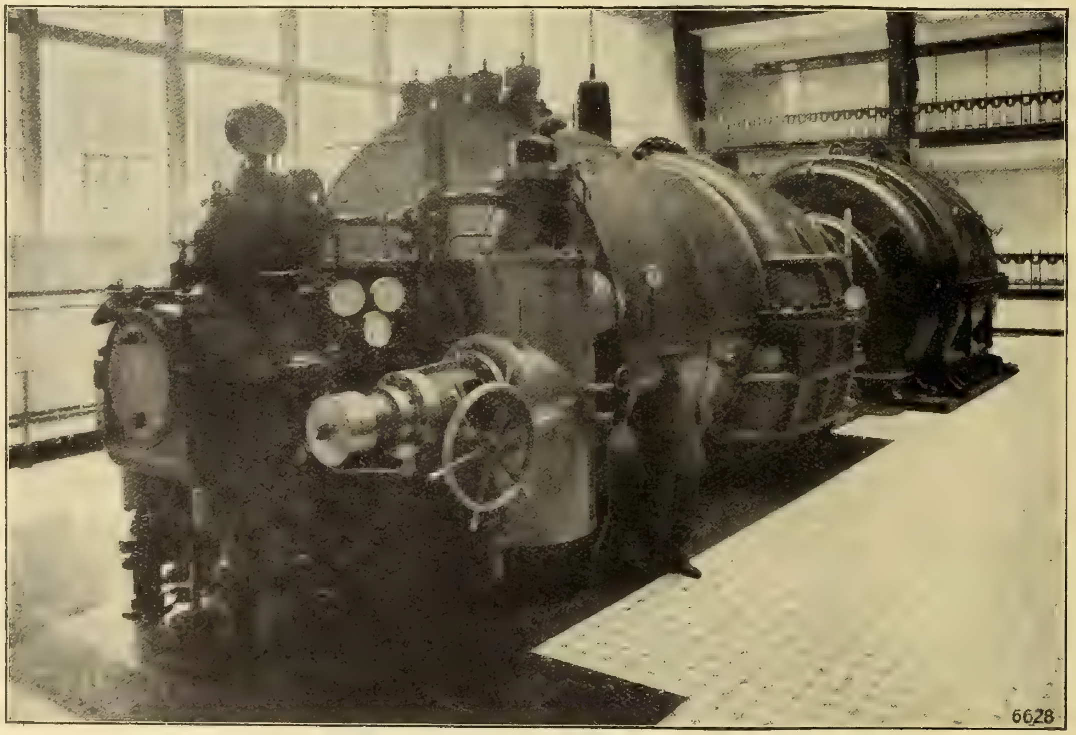
Messrs. Brown, Boveri supply complete Turbo-Generating Plants and have already put into commission over 1,000 such units, each consisting of Turbine, Generator, Condenser and Pumps. The illustration shows such a unit, of 28,000 H.P.



BROWN, BOVERI Turbo Generator unit of 28,000 H.P.

Send particulars of your requirements to

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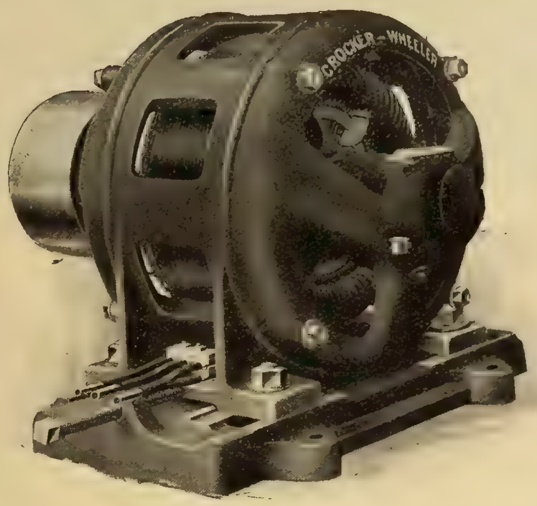

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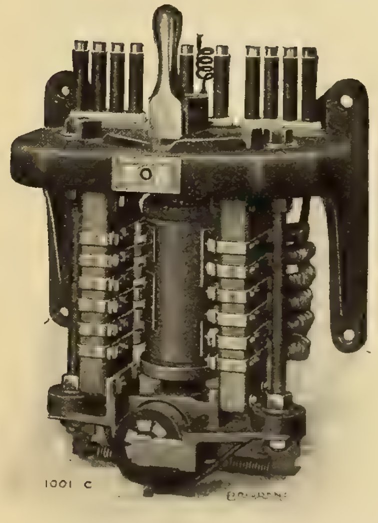

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Royal Trust Building, Montreal

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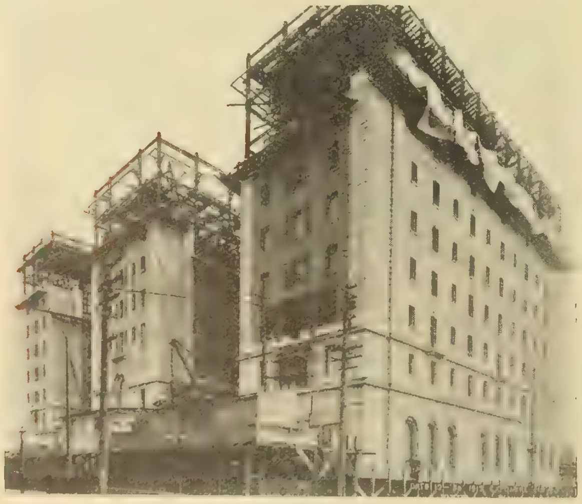
All the buildings shown in this advertisement are equipped with the above conduits.

Always specify Galvaduct or Loricated.

CONDUITS COM

TORONTO



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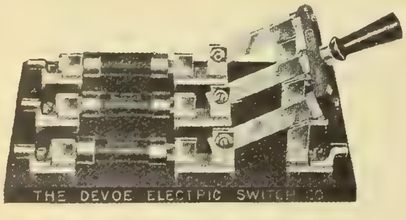

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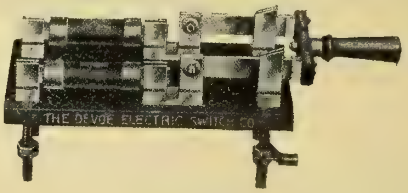

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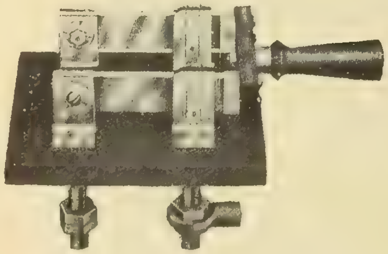

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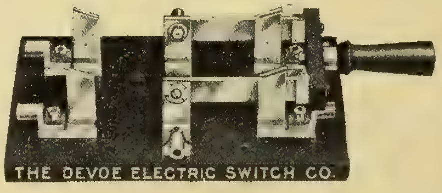

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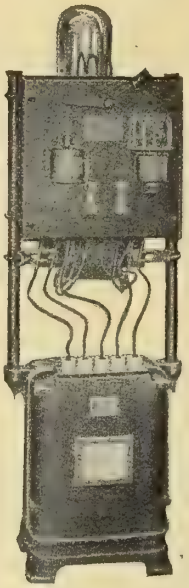

Motion Picture Rectifier

The use of the rectifier makes possible much more brilliant pictures than can be obtained when alternating current is used in the lamp.

The operation of the rectifier is easy and its use *decreases* the cost of the electricity consumed at the same time that it improves the quality of the pictures.

Write our nearest office for Booklet B-3107 giving the results of comparative tests on projection lamps using alternating and direct current, and explaining the operation of the rectifier.

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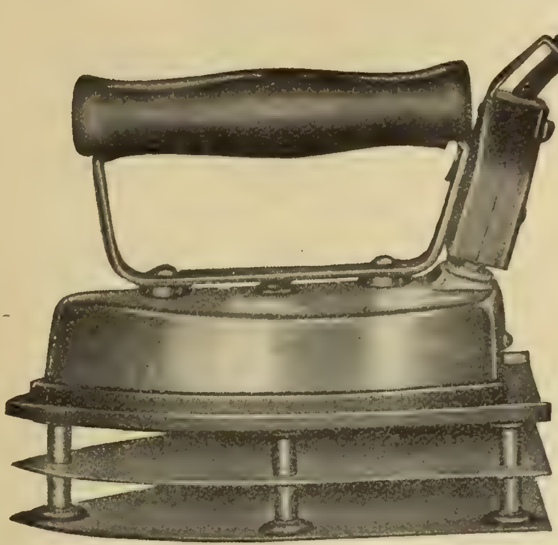
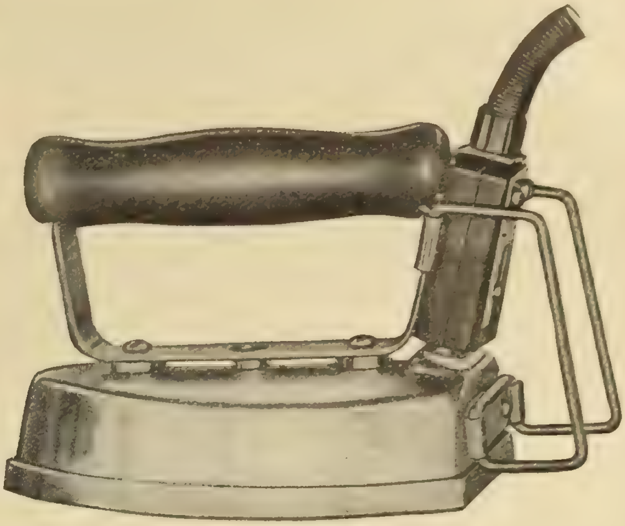


F 13-A with separate ironing stand.



F 13-B with permanent heel stand.

Guaranteed Flat Irons

WITH

Calorite Leaf Heating Units

Each of these models is the Calorite Leaf Unit design—the recognized standard of four years.

The only difference between these two irons is that the F. 13 B. iron has a permanent attached heel stand.

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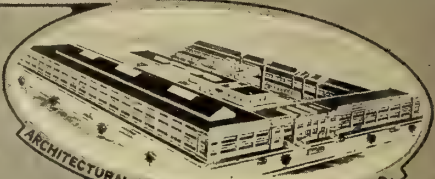

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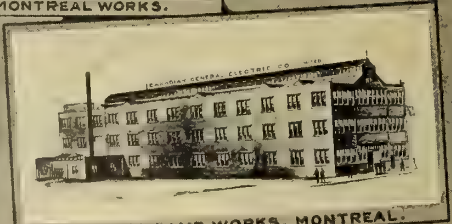

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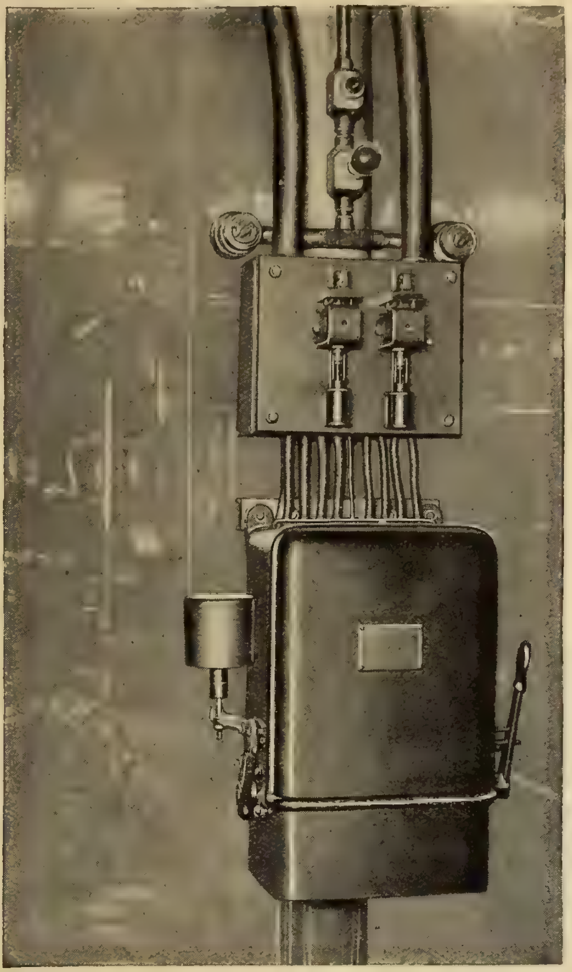

CR-117 Compensator with overload release, for controlling squirrel cage induction motors

A SILENT WATCHMAN

The modern C.G.E. compensator does more than start the motor—it protects the motor at all times.

It protects the motor during starting—for the switch handle cannot possibly be thrown to the running side unless it is first thrown to starting position.

It protects the motor when current is thrown off and on the line, for the no-voltage trip returns the starting handle to "off" position whenever the line voltage is off.

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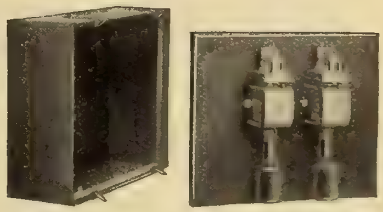

Overload relay panel with enclosing cover removed

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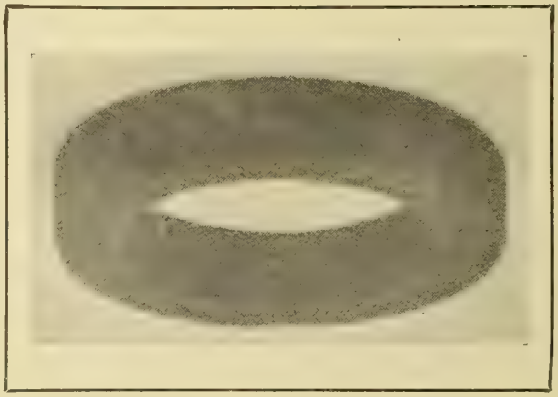

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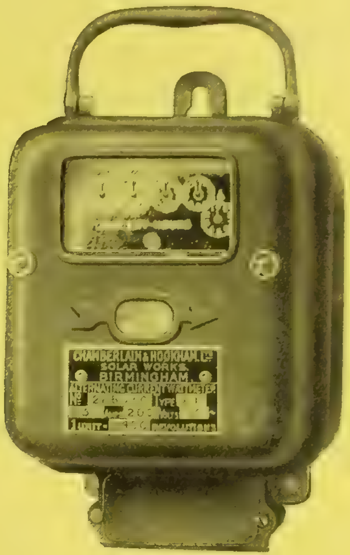

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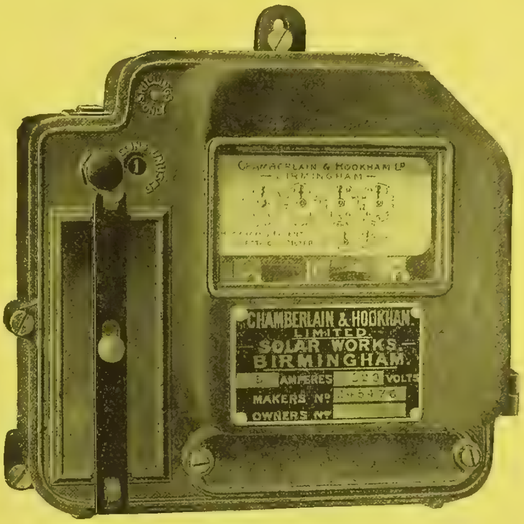

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C. & H. Meters start on an exceptionally small load and are accurate and reliable on heavy loads of constant and long duration.

Every instrument undergoes a rigid testing and examination before being shipped and we guarantee them against all defects in material or workmanship.

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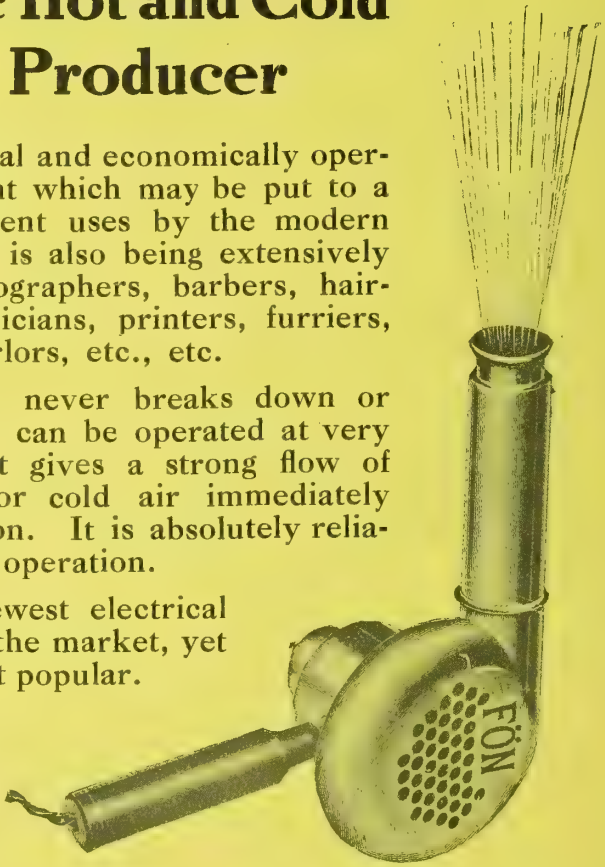

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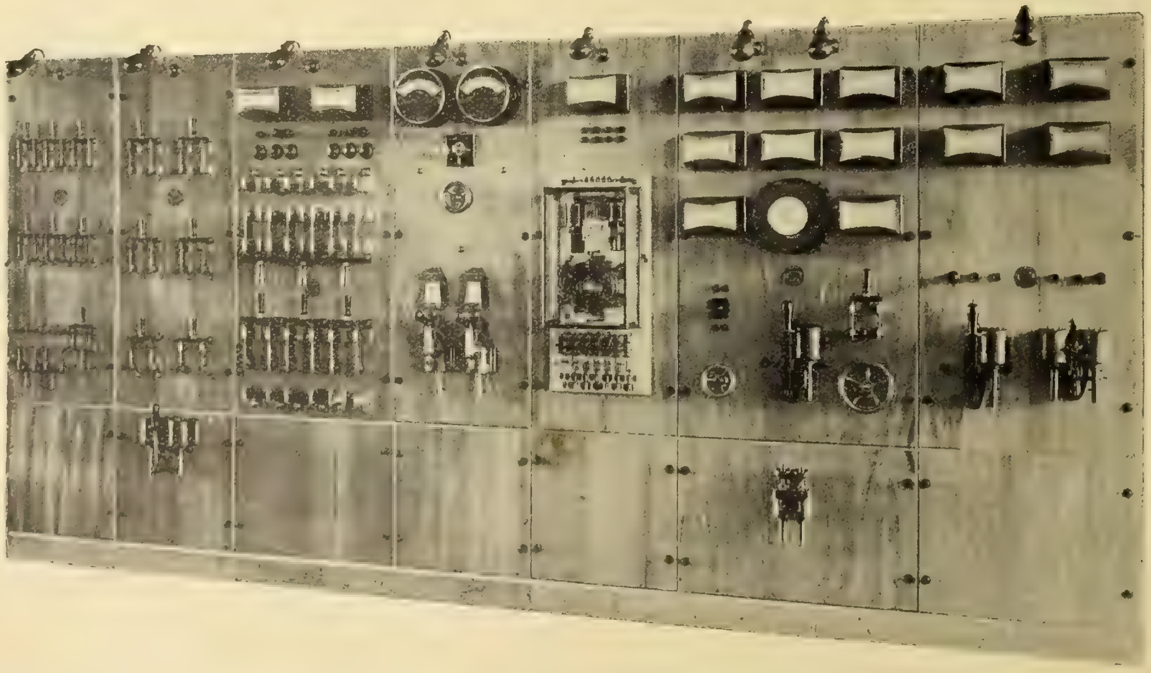

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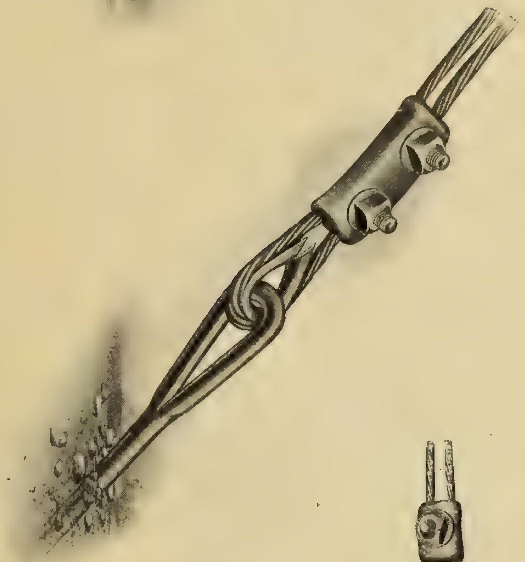

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B. & K. Brackets and Hangers are superior to all others for these very good reasons:

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4. No disturbing of cable in setting up, as a vertical movement of only 5/16 of an inch is required to insert the bracket.

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9. Due to the enormous production per day of pressed steel articles, we can produce this bracket lower in cost than any other on the market.

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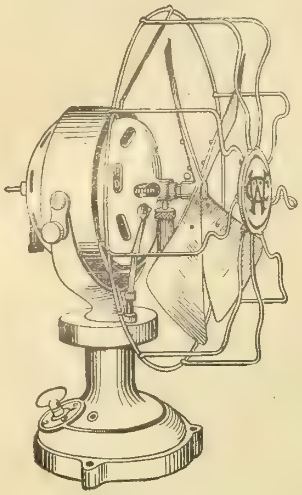

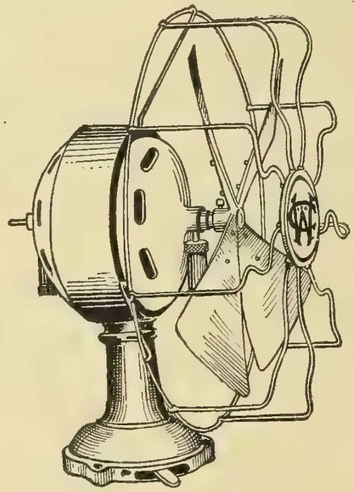

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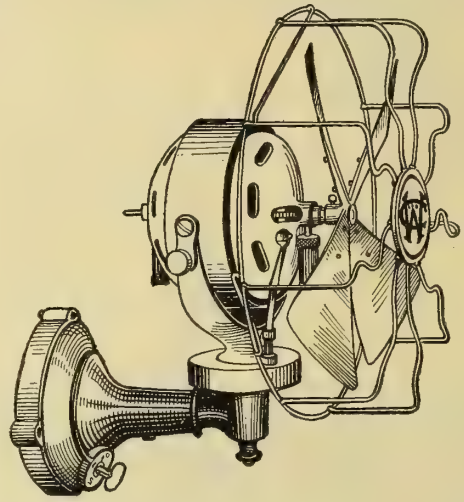

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We have a complete stock in all sizes, in direct or alternating current motors, consisting of oscillating and stationary desk, wall and ceiling fans. The designs are neat and attractive, the workmanship perfect. They are noiseless in operation and superior in every way to any thing heretofore shown.

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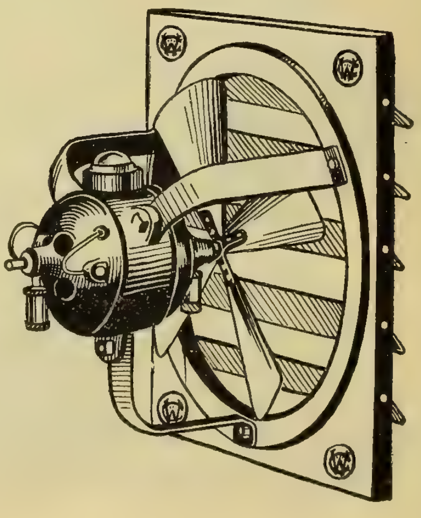

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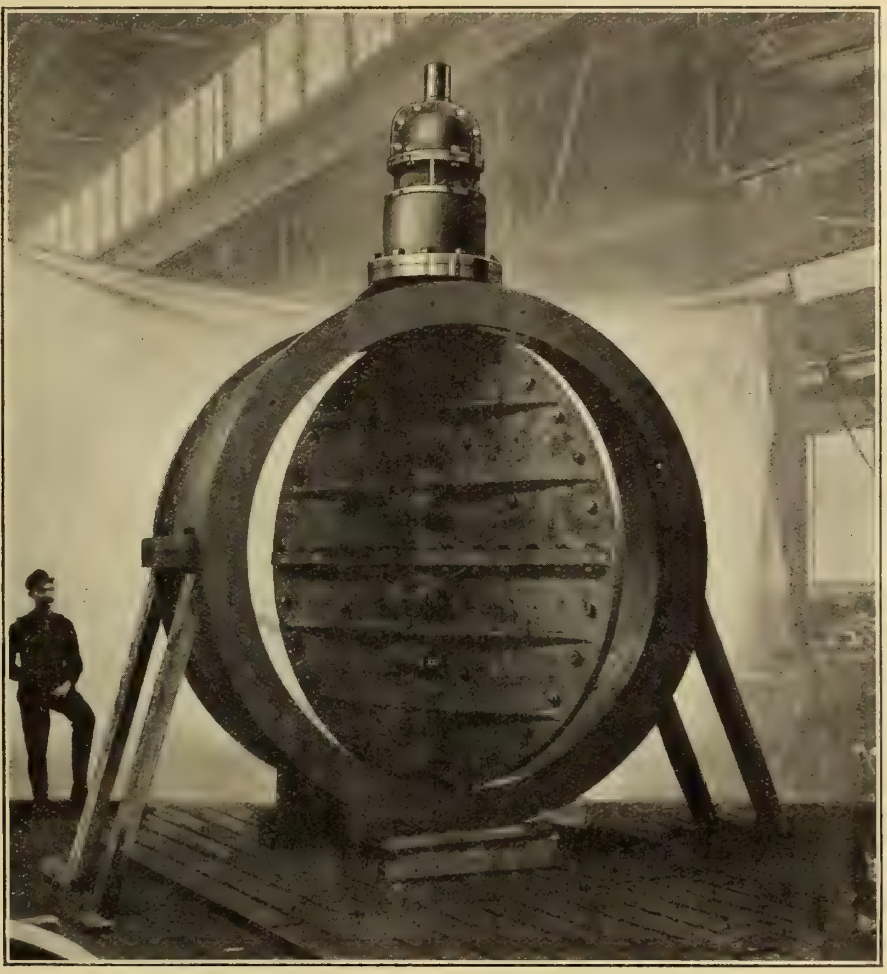

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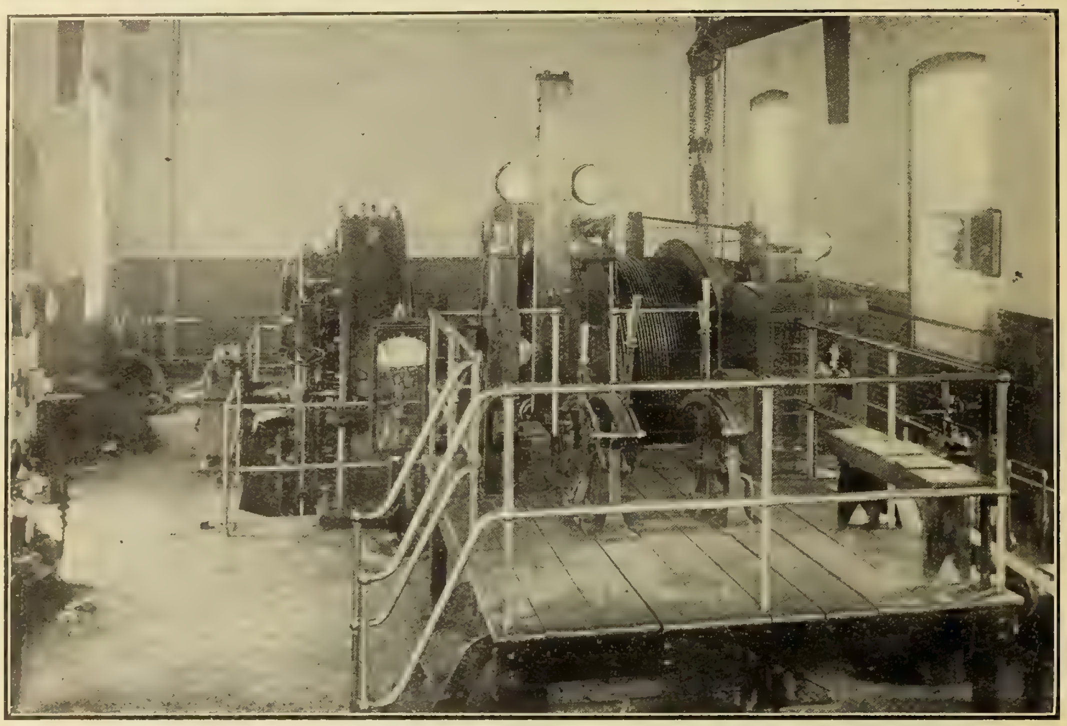

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Vol. 22 **Toronto, June 15, 1913** **No. 12**

Our Special Convention Number

While no special effort has been made to feature Toronto in our convention issue, it has happened that a number of interesting developments at present under way in the city have just reached that stage where descriptions are of special interest to electrical readers. As a result this issue contains the description of the unusual equipment being installed in Sir Henry Pellatt's house, a review of the situation with reference to municipal railway extensions which are considerable at the present moment, and also an article of much interest describing the electrical equipment of the new Toronto General Hospital. And in connection with this latter it may be said here that Toronto is apparently becoming the home of quite a large number of isolated generating plants, recent numbers of the Electrical News having described two of them, very modern installations in the head office buildings of the Bank of Toronto and of the Canadian Pacific Railway Company respectively. There is much food for thought on the installation of isolated plants in a city so well supplied with electric energy as Toronto is by both the Toronto Electric Light Company and the Toronto Hydro- electric system, and it would appear that some decidedly convincing arguments must have been forthcoming to justify such expensive and complete private installations, as all of these are, in the face of very favorable central station service conditions. What these arguments may be are not easily evident to the on-looker but these institutions are managed by business men and it is unlikely that sentiment would play any important part in a matter of the kind.

We would also like to draw the attention of our readers to the matter submitted in this issue in our advertising columns. The advertisers include practically the whole field of reliable electrical equipment, each representing in his own particular line the best in the way of manufacturing and manufactured supplies. Much thought and expense has been incurred by our advertisers in placing before you, in an intelligible form, in a few spicy, condensed sentences, the most important features in connection with their products, and the perusal of these pages alone has an educative value that cannot be obtained elsewhere in the same limited space or by the expenditure, on the readers' part of so little time and energy. As Canadians, we are proud to be able to print these important announcements which tell in such emphatic terms of Canada's industrial prominence and stability.

Canadian Electrical Association

Your attention is once more called to the dates June 25, 26 and 27, when the Canadian Electrical Association will meet in convention in Toronto to hear and discuss papers dealing with the various phases of commercial and technical electrical developments of the past year. We understand that matters of importance relative to the reorganization of the association will also be introduced and it is urged that the outcome of this discussion will only be satisfactory in proportion as the attendance is representative and the discussion general and complete.

A cordial invitation is extended to every one connected in any way whatsover with, or interested in, the electrical industry to attend this convention.

An attractive program of papers has been arranged as follows:—

C. E. A. Convention Programme

1. "Provincial Wiring Rules and National Electric Code," by H. F. Strickland, of Hydro-electric Power Commission of Ontario.
2. "Service," by Stephen L. Coles, of The Society for Electrical Development.
3. "Central Station Advertising," by D. H. McDougall, Assistant to General Manager, Toronto Electric Light Company.
4. "Underground Distribution for Small Cities," by S. Bingham Hood, Toronto Electric Light Company.
5. "Electric Vehicles from the Central Station Point of View," by C. Rummel, Manager Light and Power Department, British Columbia Electric Railway Company.
6. "Electricity on the Farm," by Jno. C. Parker, Mechanical and Electrical Engineer, Rochester Railway and Light Company.
7. "Integrating Wattmeters with Maximum Demand Attachments," by Mr. H. S. Baker, Ontario Power Company.
8. "Flame Carbon Arc Lamps," by T. J. Pace, Westinghouse Electric & Manufacturing Company, Pittsburg.
9. "Electric Heating and Cooking Devices," by Mr. Rowley, of Pacific Electric Heating Company, Toronto.
10. "The Electric Vehicle," by Stephen G. Thompson, of Electric Vehicle Association of America.
11. "Pole Type Transformers," by C. E. Sisson, Canadian General Electric Company.
12. "Magnetite Street Lighting," by W. E. Young, Canadian General Electric Company.
13. "Performance, Repairs, Maintenance and Cost of Operation of Graphic Meters," by G. D. Gratton, Electric Power Company.

The convention will be held in the C. & M. building, College street, of the University of Toronto. Arrangements have been made in the usual way for transportation. Hotel accommodation may be reserved by application to Mr. W. F. Dean, Chairman Hotels Committee, c/o C. G. E .Co., King Street West, Toronto.

Toronto General Hospital Plant

The new Toronto general hospital situated on College street and covering an area of approximately nine acres is claimed to be the most modernly equipped hospital on the continent. While this is true with respect to the equipment peculiarly adapted to hospital requirements it is no less the case from the point of view of its electrical appointments. The following article will outline briefly the installation of electrical equipment and the various uses to which it is put in the various departments of this great hospital.

The various departments of the hospital work will be isolated more or less in their own buildings, all of course, interconnected. The various departments will include the administration, medical and surgical sections, facing on College street and the pathological, emergency and out-patients' sections facing University avenue. The obstetrics building, servants' pavilion, nurses' home, private patients' home and the power house occupy two sides of the square. The hospital has been occupied in part for some time.

The power house building is a brick and fire-proof structure 40 ft. x 136 ft. A brick wall divides the engine and boiler room. The boiler room is 68 ft. x 40 ft. with the floor set 16 ft. below the street level. The ceiling and floor of the engine room and boiler rooms are of reinforced concrete. The plant is now operating very efficiently under the management of Mr. Allan Gibson.

The boiler room contains four Babcock & Wilcox water tube boilers set in two pairs with means of access between them from front to rear. Each boiler has a capacity of 500 h.p. at a pressure of 150 lbs. The boilers are fitted with Murphy automatic stokers and Dutch oven settings. Eight tons of coal can be stored on the top of each furnace. The coal is fed mechanically to the fires by means of two 8 h.p. vertical engines, one being fixed at the extreme end of each pair of furnaces. Both natural and forced draft are used, the latter obtained by means of two steam driven, 90 in. Sturtevant fans. These are automatically regulated by a Bushnell damper regulator.

The coal is carried from the bunkers to the bins on the top of each furnace by means of an electric crane supplied by J. I. Hepburn & Company. This crane is capable of carrying a load of one ton. This crane and the bucket it carries is electrically operated. The same equipment removes the ashes to one end of the boiler room, from which point they are raised by a Turnbull hydraulic lift to the street level and dumped into wagons for removal. The boiler room also contains an incinerator for the disposal of refuse. This was supplied by Heenan & Froude. In this incinerator, provision is made for feeding the refuse which, in general, will be collected in special closed receptacles, through a charging door opening placed on the roof of the furnace immediately over the drying hearth. In this way the refuse will be discharged instantaneously into the furnace without the risk of its' coming in contact with the operators.

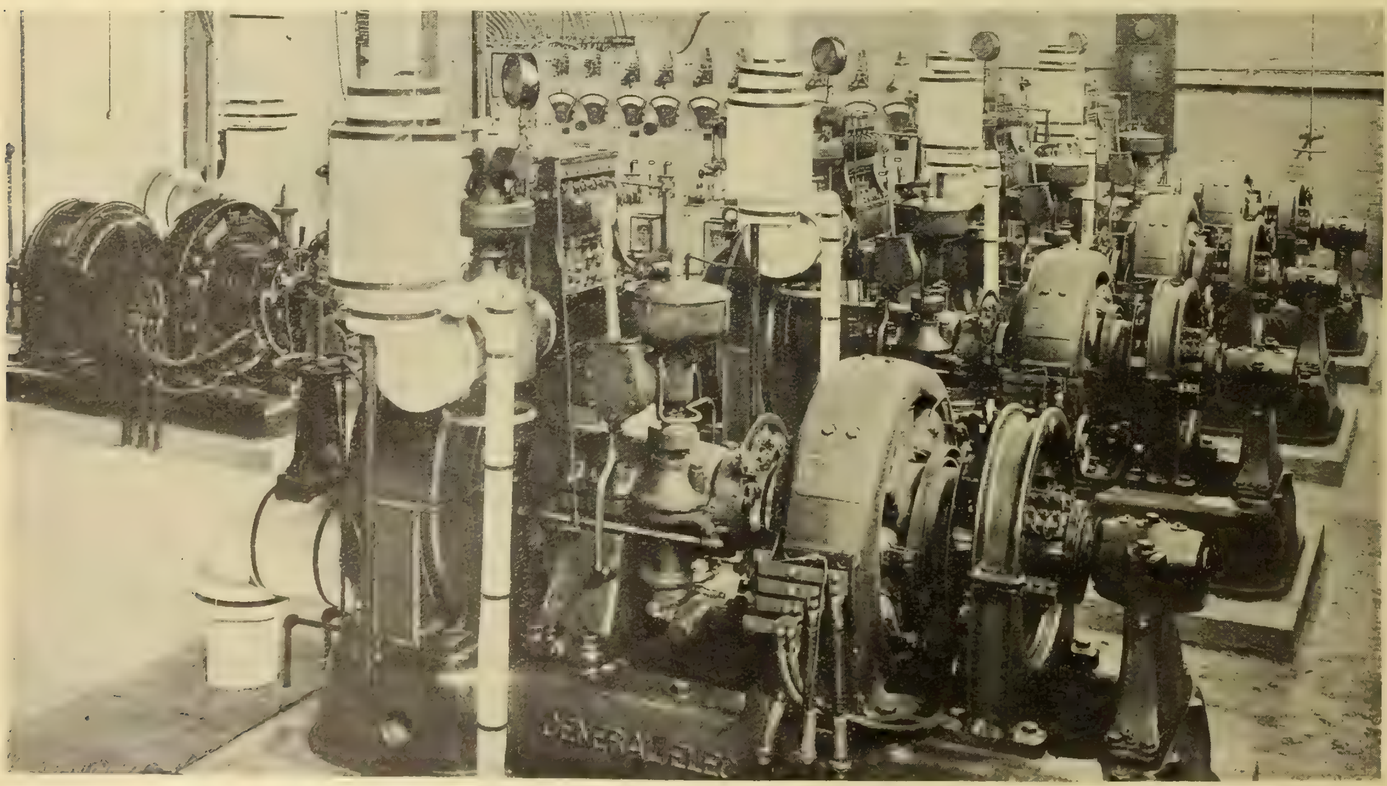
Generator Room

The generating equipment consists of four units of 125 kw. capacity installed by the Canadian General Electric Company. The generators are driven by Corliss non-condensing steam turbines 2,400 r.p.m. at 140 lbs. pressure. The generators are d.c. multi-pole, interpole, three-wire, 250 volt type. The generator armatures are air cooled by fans. There are two air gap commutators on each machine and the two a.c. collector rings are tapped in four places to the coils on that armature. Leads pass from the collector rings to a compensator below the switchboard and the end of each lead connects to a coil immersed in oil. From the centre of this coil a connection leads to the neutral bus, which will care for 25 per cent. out-of-balance load.

There is also installed a motor generator set of 125 kw. capacity, the motor being three-phase, 550 volt, 25 cycles, C.G.E. type. The generator is similar to the other four, a three-wire, 250 volt machine. This will be operated by outside current in emergency.

Switchboard

The switchboard is made up of eight panels, being 5 generator panels and 3 distributing panels, which supply light and power to the various buildings. The board complete, is 20 ft. long by 7 ft. 6 in. high. Each generator panel


Four turbo-generators in Toronto General Hospital power house—To the left a motor generator—Switchboard in background.

carries two ammeters and one watt meter as well as two circuit breakers on the outside leads. The three distributing panels carry one graphic recording wattmeter. At the right of the board is the usual pair of swing voltmeters. Everything in connection with the board was supplied by the Canadian General Electric Company.

The generated power is utilized for lighting the various buildings and also for operating a large number of small motors. When the motor installation is complete, there will probably be close to 60 units, varying in size from 1 to 10 h.p., distributed at various points throughout the building. At the present time there are about 51 motors installed.

The majority of the motors will be used to operate the ventilating and heating system. The heating of the various rooms utilizes both the direct and the indirect method, that is, certain of the rooms are heated directly from the steam coils while others are heated by air which has been warmed by passing over the heated coils. In certain of the departments the air is washed before it is allowed to enter the rooms. For example, in the surgical building there are three sets of air washing equipments and in the administration building three sets; also there is one in the operating room, two in the private patients' department, etc. The air washing sets consist of a motor-driven spraying outfit which keeps water continually sprayed over the air which a second motor, operating a fan, draws in from the outside of the building. This air, having been washed, passes up through the different rooms and is finally exhausted through roof outlets by means of fans installed in small enclosures on the roof. In all, 36 fans are used for this purpose, the sizes varying from 3 to 10 h.p.

In the boiler room two motors are installed, one of 3 h.p. capacity for operating the Yale & Towns electric lift and another of 1½ h.p. for operating the traveller. These are both controlled from the floor.

A properly equipped repair shop will later be fitted up, the various lathes and other equipment being driven by belt from two shafts, each to be driven by a small motor, probably about 10 h.p.

Though the main refrigerating system which will supply ice to the hospital is steam operated, there is one small, approximately one ton, unit operated by a 5 h.p. motor. The motor is Crocker-Wheeler type. The ice to be manufactured will in general, be turned out in 100 lb. blocks, but this will be cut into convenient sizes, as required for use, by a motor driven circular saw. A number of ice cream freezers have also been installed and these too will be operated by a 1 h.p. motor.

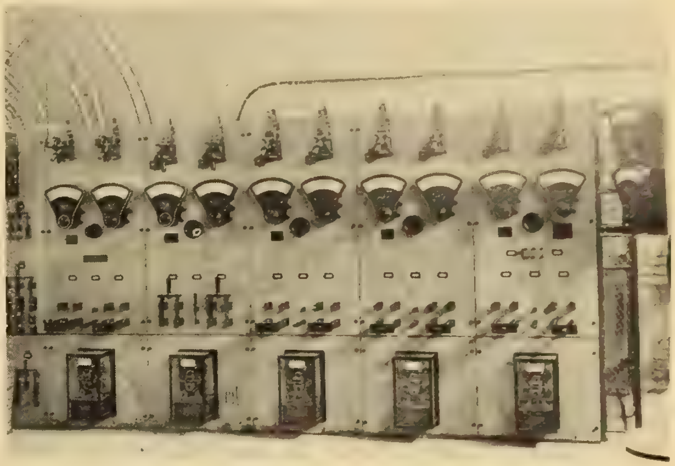
In the kitchen the washing of dishes will be attended to electrically and also in the nurses' home. In each of these two buildings a 3 h.p. motor will be used to circulate hot water among the dishes in an enclosed tank.

The Laundry

The laundry throughout is electrically operated. A battery of washers which operate almost continuously are belted to a shaft driven by a 10 h.p. C.G.E. motor. Two centrifugal dryers are operated respectively by 2 h.p. and 5 h.p. Crocker-Wheeler motors. The clothes are next put into a dry room tumbler operated by a 5 h.p. Crocker-Wheeler motor. The final drying is accomplished in a larger dry house through which air is circulated by means of a ¾ h.p. motor. The largest mangle is operated by a 3 h.p. variable speed Crocker-Wheeler motor. On this machine a Cutler-Hammer control is installed, and an emergency switch which stops and reverses the machine instantaneously. Three smaller mangles are each driven by ½ h.p. motors. The bodies of all these mangles are electrically heated. There is also a collar and cuff ironing machine driven by a 2/5 h.p. motor. In addition the laundry is equipped with ten large electric irons operating on 125 volts. All the motors in the building operate on 250 volts.

The Elevators

The Turnbull Elevator Company have installed eleven elevators in the hospital, all of the direct-connected electric type, the usual worm gear construction of winding machine being adopted. The principal feature of interest in connection with these elevators is the control system adopted on those operating in the medical and surgical wings. These elevators are provided with the usual car switch so that they may be operated by an attendant in the day time, and the usual signal system of annunciator connected to push buttons on the various floors is also provided. Since it was desired, however, to be able to use these elevators at night without the use of an attendant, the control system is provided with a transfer switch so arranged that when this transfer switch is moved from one position to the other, the car switch is disconnected and an automatic control comes into action.



Generator and distributing board, Toronto General Hospital

The pressing of the button at any one of the landings which previously registered a call on the annunciator, now acts to operate the elevator itself and the car automatically travels to the floor on which the button was pressed, and stops there, unlocking the door automatically to allow the waiting passenger to enter.

A gang push button is provided in the car connected in parallel with the buttons on the various floors, and the pressing of any particular button will send the car to the corresponding floor.

An interesting feature of this control system is the means taken to protect against accident through mis-use or ignorance on the part of the person using the elevator, and to protect against interference by other parties when one person has secured the use of the elevator. Safety switches are provided on each door so that the elevator cannot operate unless all doors leading to the hatchway are closed. In addition to this a safety door lock system is provided. This system consists of a solenoid actuated cam on the car, normally extended, which unlocks the door at which the elevator car hapens to be so that a passenger may enter, but as soon as the passenger presses the button in the car or at one of the landings, this solenoid draws back and the door automatically locks itself. The solenoid remains energized whenever the car is moving, even when passing the different floors, with the result that all the doors remain locked until the car arrives at the desired floor and then only the door at that floor is unlocked. The collapsible gates on the car itself are also connected to safety switches so that a passenger cannot operate the car until these gates have been closed, thus protecting occupants from danger due to reaching out of the car in passing a floor, or kicking against the passing floors.

The person using the car is protected from interference by other parties, by the fact that all other push buttons are automatically cut off by the pressing of any one of them and the circuit established by the pressing of any button is maintained by a corresponding relay on the controller. This relay is connected to a selector, the function of which is to send the car down when the car is above the floor for which the button was pressed, and to send it up when the car is below that floor. This selector also stops the car at its arrival at the floor by opening the circuit to the reversing magnet switch.

General safety has been provided by using a potential switch, which opens the supply line to the elevator in case of drop in voltage, or if any of the ordinary safety devices operate, such as the slack cable switch which opens in case of any slackening up of the cable or crossing of cables on the winding drum, or the over travel limit switch, which would operate if the car were to run beyond the ordinary limits of travel due to failure of the ordinary operating limit switches.

A very complete nurses' call system and powerful X-ray equipments are being installed by Mr. Geo. J. Beattie and will be described in a later issue.

Auxiliary Plant at Penticton, B.C.

The Municipality of Penticton, B.C., has recently put into operation an electric distribution system covering the whole municipal district, comprising an area averaging two miles wide and eight miles long. The district being largely devoted to fruit growing the consumers are naturally somewhat scattered, hence the choice of the distribution pressure of 4600 volts.

Owing to the difficulties in the way of doing the work in the hills the water power plant being installed by the municipality under 2200 foot head, could not be completed in time, consequently an auxiliary plant was decided upon. This has now been completed and has been put into regular operation.

The power house is a plain reinforced concrete structure 35 ft. x 35 ft. x 29 ft. 6 in., situated near the centre of load and surrounded on three sides by a beautiful grove of evergreens. The motive power is furnished by one two-hundred-brake horse-power Mirrlees Diesel engine supplied by the Canadian Boving Company. The engine, which will ultimately be directly connected to a 125 kw. generator, is temporarily belted to one of the generators ordered for the water power plant, the overhung impulse wheel being replaced by a cast steel pulley.

Power House, Penticton, B. C.

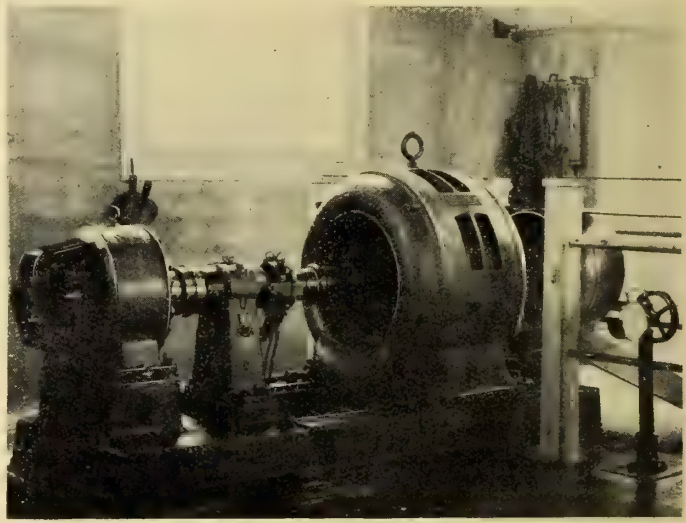
The generator was manufactured by the Lancashire Dynamo Works and is of one hundred kw. capacity at 4660 volts, three phase, 60 cycles, and has its exciter directly connected. The speed is nine hundred revolutions per minute.

The switchboard was supplied by the Canadian Westinghouse Company and consists of three panels of black marine finish slate. The switchboard is also part of the equipment for the water power scheme and includes two generator panels with one main line panel. This switchboard is so designed as to permit of the addition of one exciter panel, two generator panels and one feeder panel in the order named on the right of the present panels.

The generator switches are non-automatic, The station lightning arresters are Westinghouse type "S" low equivalent.

The power house building is laid out to accommodate two 200 B.h.p. direct connected units which will constitute a permanent reserve station for use in connection with the completed water power system.

The fuel oil storage tanks of 10,000 gallons capacity are located one hundred feet away from the power house, convenient to a spur from the Kettle Valley Railway and at such level as to permit of unloading the tank cars by gravity. The cars at present come by way of the C. P. R. to Okanagan Landing where they are loaded directly on a car barge and towed to Penticton. On completion of the Kettle Valley Railway through to Vancouver this haul will be considerably shortened.



Generator and exciter, Penticton, B.C.

An interesting feature in connection with the hydro scheme is that the water after being brought eight miles from the hills to the water wheels, will be discharged into the domestic water supply system of the municipality assuring a supply of uncontaminated water.

The distribution system is of standard construction using forty foot poles, single phase primary branch circuits and three wire secondaries. The transformers are Canadian General Electric type "H" and are provided with howitzer type fuses. Owing to the severe lightning storms encountered in this district the lines are protected every mile by Canadian General Electric Company "Multipath" arresters grounded to the water pipes.

The street lighting is by the Westinghouse series adjuster socket system using tungsten lamps from 60 to 200 candle power. The lamps are spaced one hundred feet apart in the business section, and two hundred feet apart in the residential section; the agricultural section is provided with lamps only at corners and dark places.

The service was inaugurated with one hundred and fifty-six connections but is growing rapidly and is now on a sound financial basis.

The plant was officially started by ex-reeve Capt.

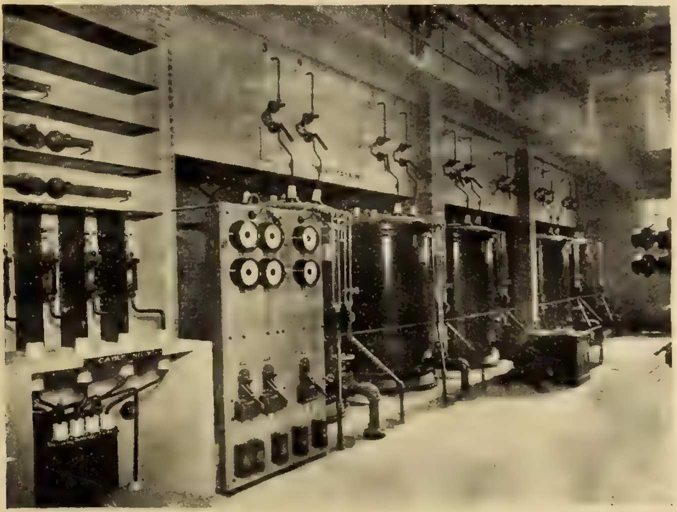
Stevens in the presence of reeve Foley-Bennet, the councillors and a representative gathering of the citizens. The service is at present during the night only, a full twenty-four hour service being under consideration owing to the pressing demand for electric power and heat. The pole lines were built by the Penticton Electric Company, composed of Messrs. McDonald and Rowe.

Mr. F. L. McKeever, M.I.E.E., is superintendent. He has had a wide experience in Great Britain, Germany and the East Indies. Mr. F. H. Latimer, C.E., of Penticton, is advising municipal engineer with Messrs. Mather, Yuill & Company, of Vancouver, consulting engineers.

New Ottawa Electric Substation

The Ottawa Electric Company have just opened for operation a new sub-station on Slater street, two views of the interior of which we reproduce herewith. This company has three power houses, two hydro-electric and the third steam turbine driven. Power in the last station is furnished by water tube boilers connected to Westinghouse Parsons turbines. This station takes care of peak loads in winter and may be used in case of accidents or when it is desired to close down one of the hydraulic units. These two stations feed their power into the central station at a generating voltage of 2,200 where it is stepped up to 12,000 volts and transmitted by underground cables to the sub-station on Slater street. At this station it is stepped down to 2,200 and distributed.

Interior Ottawa Electric new substation.



Interior Ottawa Electric new substation.

The Slater street equipment consists of Westinghouse oil-filled water-cooled transformers of 1,500 kv.a. capacity. Sixteen pairs of feeders pass out from this station to different points in the city. The out-going distribution is underground for from 1 to ½ dozen blocks from the sub-stations. This prevents crowding of wires about the sub-station. It also permits of the city east of the Rideau Canal being supplied without a single wire across the New Plaza between the Chateau Laurier and the post office. The new sub-station is of fireproof construction and the equipment is most modern in all respects.

Montreal L. H. & P. Developments

According to the annual report of the Montreal Light, Heat & Power Company, the gross income for the year 1912 was $5,509,556, an increase of $540,302, and the net earnings $3,181,116, an increase of $337,100. After deducting fixed charges, dividends, pension fund and putting $550,000 to depreciation account, a surplus of $627,137 is left to general surplus account, an increase of $128,869. The company improved its operating ratio, which was 42.26 per cent. of gross in 1913, against 42.76 per cent. the year previous. In his report, Mr. H. S. Holt, the president, states:—

"In the electric department your directors during the year entered into a long term and favorable contract with the Cedars Rapids Manufacturing & Power Company for the supply of 60,000 horse-power from their Cedars development to be taken as and when required, and in virtue of the agreement it is incumbent upon our company to transmit the power to Montreal. For this purpose a steel tower transmission line will be completed simultaneously with the Cedars development. Consequent upon the acquisition of additional hydraulic power from the Cedars Rapids Company as intimated, and with a view to maintaining a definite ratio between steam reserve and hydraulic power, your company has planned a new central auxiliary steam station of a capacity of 25,000 horse-power (with provision for an ultimate capacity of 50,000 horse-power) to safeguard the company and its consumers against possible interruptions and variations affecting its hydraulic supply. This station, it is expected, will be ready for operation in October of the present year.

The shareholders, on June 3rd, decided to issue $1,800,000 stock at par, $100,000 of which will be reserved for the employees. The board is composed of: H. S. Holt, president; Sir Rodolphe Forget, vice-president; Hon. Robert Mackay, Sir H. Montagu Allan, Hon. H. B. Rainville, C. R. Hosmer, J. E. Aldred, George Caverhill, Hon. Narcisse Perodeau; J. S. Norris, general manager and secretary-treasurer.

New Books

Rivers and Estuaries—by W. Henry Hunter, M.I.C.E. Longmans, Green & Company, publishers. Distributed through their agents for Canada and Newfoundland, The Renouf Publishing Company, 25 McGill College Avenue, Montreal; price 75c. This is an elementary study of the subject based to a large extent on a series of lectures delivered at the desire of the council of the Institution of Civil Engineers to the students of the institution in various parts of Great Britain and on further lectures on the subject of "Streams and Tides," delivered to the students in the Department of Engineering in the University of Manchester.

497. Electric elevators—An old-established London firm of electric elevator manufacturers wishes to arrange for their sale in Canada.

Ample Power Facilities in Regina

The present plant of the municipality of the city of Regina is located at the corner of Broad street and Dewdney avenue, a whole block being reserved for the generating plant, stores building and incinerator. The power house building has a 37 ft. engine room and 90 ft boiler room. The boiler room is arranged for two rows of boilers facing the firing floor. At present only one row of two batteries consisting of one battery of two 250 h.p. and one battery of two 500 h.p. B. & W. boilers have been installed, but requirements of the city will call for the remaining batteries in the near future. At the rear of the row of batteries now installed and outside the main boiler room is located an 84 ft. chimney; also a 50,000 cubic ft. per minute induced draft fan serving the battery of two 500 h.p. boilers.

In the boiler feed room, 20 ft. x 52 ft., which surrounds the base of the chimney, there are located two sections of 160 tubes each of Green economizers, a 10½ in. x 8 in. x 24 in. Weir feed pump, a 7½ in. x 5 in. x 10 in. Knowles Duplex feed pump, a 7 in. x 5 in. x 8 in. Fairbanks-Morse pump, a Webster class E. C. heater 1200 h.p., and a receiving tank for all the condensed steam of the plant. At the rear of this room is located a spur track for the supply of coal and a small temporary scraper conveyor which carries the coal from the track to a point at the ceiling in the centre of boiler room. The space for future boilers is being used for coal storage at present. A 1,000 ton coal shed is located at one side of the boiler room but is not at present being served by the conveyor, being used only for a reserve supply.

The Engines and Generators

The engine room is served by a 15-ton Whitney crane and contains the following machinery:—

A 22 in. x 30 in. 150 r.p.m. Inglis Corliss engine connected to a 300 kw., 2200 volt, 3-phase, 60 cycle Westinghouse generator with a 10 kw. 125 volt, direct connected exciter on the outboard bearing.

A 11-in. x 20-in. x 14-in. tandem Goldie-McCulloch Ideal engine direct connected to a 100 kw. 2200 volt, 3-phase, 60 cycle Westinghouse generator with a 5 kw. 125 volt, direct connected exciter.

A 500 kv.a. low pressure turbo-generator, 2200 volts, 3-phase, 60 cycle, 3600 r.p.m. to operate with the exhaust of the above two engines. The turbine is served by a C. H. Wheeler condenser consisting of a 3,000 square ft. shell with a 16-in. x 32-in. Rotrex air pump and a 10-in. centrifugal circulating pump driven by a 9-in. x 9-in. Sturtevant engine, both pumps being direct connected with a 1½-in. centrifugal lift pump driven by a silent chain from main air pump shaft elevating condensate to hot well tank in boiler feed room.

A 25 kw. 125 volt, 3500 r.p.m. turbo-exciter is also installed as a standby exciter exhausting into this low pressure turbine when used, the low pressure turbine normally taking exciting current from the exciters direct-connected to engines operating with the low pressure turbine.

An 1875 kv.a. 2200 volt, 3-phase, 60 cycle, 1800 r.p.m. Willans & Robinson-Siemens turbo-generator which is of the combined impulse and reaction type and is served by a Mirrlees-Watson condenser consisting of a 4400 square ft. shell, a 50 h.p. Alley & McLellan engine, being direct-connected to a 14-in. Orten-Boving centrifugal pump and geared to a twin Edwards air pump 18-in. x 10-in., and running at 100 r.p.m. A plunger pump driven from crank on air pump shaft elevates the condensate to the tank in boiler feed room.

Two 400 kw., 800 volt Siemens direct-current generators direct-connected to Belliss & Morcom engines which exhaust into a C. E. Wheeler condenser consisting of a 1300 square ft. shell with a 10-in. x 20-in. Rotrex pump and a 6-in. centrifugal circulating pump driven by and direct-connected to a 6-in. x 6-in. Sturtevant engine, the condensate being elevated to the tank in boiler feed room by air pump without any assistance.

All engines are supplied from a 10-in. steam header which is located on the wall next the boiler room, the header being supplied at two points corresponding to the two rows of boilers, the pipes being arranged so that when the additional rows of boilers are installed it will form a ring. Space is left in the engine room for the future installation of a 1875 kv.a. turbo-generator.

The Switchboard

The switchboards are located at the west side of the engine room farthest away from the boiler room in an elevated gallery supported by steel beams from the floor of the basement and cross channels tied into the west wall of the building. The a.c. board consists of two exciter panels with Tirrill regulator, four generator panels for the control of the four a.c. generators, a spare panel for a future generator and a totalling panel in which power and light are separated with curve drawings and integrating watt meters on each; also oil switch for tying bus-bars together; on the extreme right of the board are six feeder panels on which are mounted 300 ampere, Westinghouse type B, circuit breakers.

The switchboard is arranged with two sets of exciter bus-bars, all exciter and generator fields being fitted with double throw switches, also two sets of a.c. busses with double throw generator switches. Power is taken from the main bus-bar through an oil switch and integrating watt meter to auxiliary bus-bar for all street lights. These auxiliary bus-bars supply current to two 50-light 6.6 amp. Westinghouse air-cooled constant current transformers, four 50-light Westinghouse 6.6 amp. constant current transformers, and rectifiers for metal flame arc lamps.

The d.c. switchboard is of Siemens manufacture, and consists of two generator panels, a totalling panel and three feeder panels. The generator panels are fitted with Siemens reverse power and overload circuit breakers, two knife switches, and an ammeter. The totalling panel is fitted with two voltmeters with plugs, a totalling ammeter and an integrating watt-meter. The feeder panels are each supplied with single pole knife switches, ammeters and plain overload circuit breakers. Distribution is at 2200 volts, 3-phase, 60 cycles, for both light and power, which, however, are kept separate.

Distribution

The lines are located in lanes except where street lighting requires street poles. The street lighting in the main business section is by metal flame arc lamps with Alba globes supported by metal poles spaced 100 feet apart at the curb on one side of a 66 ft. street. An ornamental top has been used on trolley poles wherever these were available and a similar lamp pole has been used with the same design of top for the business streets. The residential districts are lighted by metal flame arc lamps located at street corners and supported by Cutter mast arms on wooden poles, every corner being supplied. 100 Westinghouse 6.6 amp. alternating current lamps are also used in the outskirts of the city.

The increase in the business of Regina's electrical department was approximately 75 per cent. during 1912 and the first four months of 1913 have shown an increase of 86 per cent. over the same period a year ago.

A New Power House

To meet the demand of business increase, the city is undertaking the construction of a complete new power house located close to Wascana Lake where circulating water is available. The plant will have a capacity of 12,000 kw. normal rating, and contracts have been let for equipment as follows:

Boilers—The Babcock-Wilcox Company for six 500 h.p. 200 lbs. pressure, 125 deg. F. superheat.

Stokers—The Sandford Riley Stoker Company for six 6-retort Riley underfeed stokers.

Economizers—The B. F. Sturtevant Company for six groups of economizers, each group having 160 twelve foot tubes.

Induced draught fans—The J. A. McTaggart Company for two 133,000 cu. ft. Sturtevant fans and stack.

Feed pumps—Peacock Bros. for two 12-in. x 9-in. x 24-in. Weir pumps.

Feed water heater—The Canada Foundry Company, for one Cochrane heater and meter; capacity 150,000 lbs. per hour.

Street railway generator—The Roper Clarke Company, for one 1200 kw. Peebles-Lacour motor converter with switchboard.

Street lighting—The Canadian Westinghouse Company for four 75-light metal flame arc lamp equipments 6.6 amps.

When the new power house, which is laid out with all modern equipment is completed, the old power house will be used for a water pumping station and street railway and street lighting sub-station. The cause of the changing of the location of steam generating equipment has been the insufficiency of the supply of circulating water for the condensors owing to the remarkable growth of the load.

The street lighting programme for 1913 will double the number of street lamps in use in this city.

In addition to this a scheme consisting of doubling the lighting in the business section is petitioned for, which will be done on the local improvement plan, and, when completed will make Regina second to none in Western Canada for street lighting.

Society of Electrical Development

The Society for Electrical Development recently formed for the object of bringing the value and variety of electrical appliances more prominently before the general public, have outlined a general plan of advertising and publicity which promises to have far-reaching results in popularizing the use of this modern necessity. It has been decided to hold the annual convention in Chicago on May 31st, so that the members of this society may also have a chance of attending the annual convention of the National Electric Light Association.

The general plans of the Society for Electrical Development, as recently published, are given herewith, from which the scope of the organization may be judged. It is understood that these plans have the approval of the National Electric Light Association, the National Electrical Supply Jobbers' Association, and the National Electrical Contractors' Association.

Advertising

A national advertising campaign in general magazines, trade and class papers, etc. This campaign to be of a broad educational nature designed to educate the consuming and non-consuming public to the many advantages of electricity for light, heat, power and other useful purposes, including special arguments for adequate wiring circuits, outlets, etc.

A comprehensive follow-up system in connection with the above so that each individual member will receive a copy or notification of every inquiry coming from his locality and the manufacturing members will receive direct copy or notification of every inquiry made relating to the apparatus which they manufacture.

Stimulating and assisting in the publication of educational literature of various kinds to architects, builders, other trades and the public, including publications of a similar character to those now being issued by the Commercial Section of the National Electric Light Association, Illuminating Engineering Society and by other outside agencies, and where it is not possible to stimulate the publication of booklets of this character, organization of this department to prepare those which seem necessary or advisable.

Booklets of an educational nature to be used as far as possible in answering direct inquiries coming from national advertising and other sources and also to be supplied in quantities at a minimum cost to members for local distribution through co-operation with the above agencies.

Collecting of material from central stations, manufacturers, advertising agencies, etc., and preparation of additional material if advisable, so that specific information can be furnished relative to advertising copy and cuts for newspaper advertising, booklets, folders, envelope stuffers, circular letters, etc., to assist members in planning and carrying out advertising campaigns. This can be accomplished at low cost by close co-operation with members, advertising agencies, etc.

Advising and arranging for and furnishing material for national publicity and advertising weeks (or months) on certain phases of electricity.

Accumulating and furnishing to members data regarding development and sales campaigns to increase the use of electric signs, improve and develop street lighting, power, heating, etc.

Maintaining of information bureau for statistics and data of various kinds relating to commercial subjects—merchandising, selling campaigns, advertising, etc.

Publicity

The accumulating and disseminating of data, photographs, etc., for use in newspapers, general magazines, trade and class papers, as well as to free lance writers, furnishing data, articles and stories of all character to all classes of publications including architectural, building, farm publications, women's magazines, etc., etc.

Furnishing articles and information to the trade press as well as to the bulletins of the National Electric Light Association, the Jovian Order, National Electrical Contractor, Illuminating Engineering Society, Efficiency Society, etc., etc.

Furnishing of a news service to members to be used locally in newspapers.

Arranging with newspapers through the country and with magazines, newspaper syndicates, trade press, special writers, etc., for stories, articles and information.

Furnishing of news material to co-operative newspaper pages where requested.

Preparing and disseminating of articles and information which will assist in the unification of water power laws, electrical ordinances, sign and wiring regulations and the like.

Preventing as far as possible the publication of untrue articles or stories tending to injure the business or mislead the public and to correct any misinformation published.

Field and General Effort

Co-operation with Jovians and other electrical societies and organizations as a national proposition and locally among the various branches and local leagues to obtain co-operation in the industry and in the carrying out of the Society's work.

Suggesting various ways and means for co-operation among the different electrical interests in the electrical and allied industries and stimulating as far as possible more harmonious relations and wider co-operation among the various interests engaged and either by stimulating local endeavor or by carrying out work direct, assist in various lines of local development, etc., etc.

Suggesting ways and means of co-operation locally in the various cities with the Chambers of Commerce, Boards of Trade, etc., for the development of the electrical business and the development of cities.

Addresses by trained men before various electrical societies and before architectural, building trades and various other industries to increase co-operation and acquaint them with the greater value of electricity for light, heat, power and all other useful purposes.

Working nationally and locally for better co-operation with Underwriters' Laboratories throughout the electrical business to improve conditions generally, a special committee to be appointed for this purpose.

Stimulating and assisting in organization of co-operative community advertising.

Arranging locally for equipping of various industrial plants for electricity to the fullest point of saturation.

Exchanging information regarding plants so equipped and arranging for publicity throughout the industry and to the public regarding such plants.

Assisting in plans for bureau for lectures and demonstrations in various cities.

Assisting general co-operative plans for moving picture exhibitions, exchanging of films, etc., perhaps in connection with traveling electrical show.

Assisting by suggestion in ways and means for developing day-load electricity on the farm, household appliances, power, etc.

Maritime Electrical Activity

The Fredericton Gas Company plan the installation of a 300 kw. high pressure condensing turbo-generator set with direct connected exciter. Tenders are in and contract will be awarded shortly. This company is also planning on extending their lines across the St. John River to connect up the towns of Gibson, St. Marys and Marysville. These towns are at present without an electric service. In connection with this work there is a draw-bridge to be crossed which on account of local conditions presents a rather difficult problem.

Amherst, N.S.

The Canada Electric Company have recently placed an order with the Can. Gen. Elec. Company for one 1000 kw. Curtis high pressure condensing steam turbo-generator set. This machine will be wound for 11,000 volts, 3-phase, 60 cycles and will be installed in their Chignecto power house. On account of the industrial activity in Amherst the power company's load has increased very rapidly. Lightning recently struck and set fire to their Amherst sub-station, doing considerable damage. Several of their linemen had a narrow escape while endeavoring to remove transformers from the burning building.

St. John, N.B.

The St. John Railway Company are making considerable extensions to their lines in order to connect up the new industries starting in the suburbs of St. John. To take care of their increased load orders have been placed for additional equipment, including one 2,000 kw. C. G. E. Curtis mixed pressure turbo-generator set, the generator being 3-phase, 60 cycle, 2200 volt. This company also recently placed an order for additional street lighting equipment, which included a fifty light constant current transformer and fifty a.c. series lamps. They are planning the installation of a motor generator set in the near future.

Dartmouth, N.S.

The Acadia Sugar Refinery Company, whose plant was recently totally destroyed by fire, are now re-building on a larger scale than before. The new refinery when completed will cost about two million dollars and will be electrically driven throughout. Three 750 Westinghouse turbo-generator sets will be installed. There will be about sixty motors used around the plant. The order for motors has not yet been placed. In connection with the power plant the company have erected one of the largest chimneys in Canada, the dimension being height 255 ft., diameter at bottom 21 ft., inside diameter at top 11 ft. John Starr & Company, has the contract for wiring the building which will be done in conduit. James Buchanen & Company, Liverpool, England, are the consulting engineers.

Campbellton, N.B.

The Corporation of Campbellton have recently placed an order with the Canadian General Electric Company for a 25 kw. series luminous magnetite equipment. This is a duplicate order of the one installed after their fire and includes, besides the rectifier and transformer, 25 series magnetite lamps with cutouts and arms. This town is operating a gas producer plant consisting of 2 Canada Foundry producers of 150 h.p. each, one 2 cylinder 180 h.p. Premier engine and one 4-cylinder 350 h.p. Premier engine. The electrical equipment includes 1-100 kw., 3-phase, 60 cycle, 2200 volt, belt driven generator with belted exciter and 1-200 kw., 3-phase, 60-cycle, 2200 volt unit. The switchboard comprises five panels with a complete equipment of instruments including a Tirrill regulator. The complete equipment was supplied by the Canada Foundry Company and Canada General Electric Company, and was installed by the town's superintendent, Mr. H. G. N. Farrer. Great claims are being made by the town regarding the high economy of this plant.

Halifax, N.S.

The Halifax Tramway Company had during the past month the only serious labour trouble since the starting of their tramway. This was a strike of the motormen, conductors and car barn employees. The company in anticipation of a strike imported some fifty substitutes from Montreal, and immediately after the men walked out they attempted to operate a service. After having a number of cars and the main office building badly smashed by strike sympathizers the service was discontinued and Halifax was without cars for five days. The men went back to work with an increase of 1½ cents per hour and signed a two-year contract along these lines.

Sydney Mines, N.S.

The Nova Scotia Steel & Coal Company are planning on a quantity of new developments in connection with both their mining blast furnace departments. This will require considerable additional electric equipment. They recently put in operation at this plant a 1000 kw. high pressure turbo-generator set consisting of a Fraser, Chalmers turbine and a Siemens a.c. 3-phase, 60-cycle, 2200 volt generator. Orders were recently placed with the Siemens Company for a 125 h.p. a.c. hoisting outfit, using the Ward Lenord System. Also an order with the Canadian General Electric Company for 1-300 kw. synchronous motor-generator set, the generator to furnish 250 volt direct current for mining machinery. This order includes sub-station equipment, transformers being 150 kw. each, 11,000 to 2,200 volt.

Sydney, N.S.

The Cape Breton Electric Company are discontinuing the operation of their steam driven plant at Glace Bay and in place of same are installing at Reserve Junction a 300 kw.

synchronous motor-generator set for operating the Sydney and Glace Bay Electric Railway. A 22,000 volt transmission line is being constructed from their Sydney power house to Reserve Junction. When the motor generator set is installed the steam plant will be removed to their North Sydney sub-station. The Canadian General Electric Company have the contract for motor-generator set and sub-station equipment also for new switchboard at Sydney power house.

New Glasgow, N.S.

The Pictou County Electric Company have recently added to their rolling stock three double truck, four motor, semi-convertible cars to take care of increased business due partly to the new car works at Trenton, and are now operating a fifteen-minute service between Trenton and Stellarton. This company has shown a remarkable growth during the past three years and are supplying the towns of Westville, Stellarton, New Glasgow and Trenton with a splendid tramway, light and power service. In order to meet the increased load, orders have been placed with the Canadian General Electric Company for 1-300 kw., 600 volt, 300 r.p.m. d.c. railway generator for direct connection to a Robb vertical compound engine; also 1-150 kv.a., 60-cycle, 3-phase, 2200 volt, 450 r.p.m. generator for direct connection to a Robb vertical compound engine. This equipment will be installed in the company's Stellarton power house.

Value of an Electric Vehicle Load

With the increasing use of electric vehicles for both pleasure and commercial purposes central stations are paying more attention to battery charging as a primary source of revenue rather than a secondary one, and the wisdom of this practice is revealed by the fact that one electric light company last year earned $150,000 net from this source alone. The original practice of viewing battery charging as an excellent "side line" to assist in reducing overhead expenses, is rapidly giving way to the more logical view that it may with profit be made a specialty, in charge of qualified experts ready and willing throughout the whole twenty-four hours, instead of during only that time when the central station meters do not indicate the peak load.

The nation-wide rate of increase in electric vehicles last year was over 200 per cent. In large cities the growth has indeed been rapid: for instance, in Boston the rate of increase in the last two years was 134 per cent. In New York the number of electric vehicles in service grew 45 per cent. between the summers of 1911 and 1912, and in the last two years electric trucking has increased 400 per cent. in Chicago.

Since the Public Service Corporation of New Jersey entered the campaign two years ago, the number of electric vehicles in its territory has risen from 139 to 440, and the average cost of charging service has been reduced from slightly over 4 cents to about 3.5 cents per kw.hr. About 80 per cent. of the commercial electric vehicles are used east of the Alleghanies, the heaviest demand for pleasure cars coming from the middle west. On the streets of Chicago there are over 3,500 electric pleasure cars and Denver has a greater percentage of pleasure cars per capita than any other city in the country.

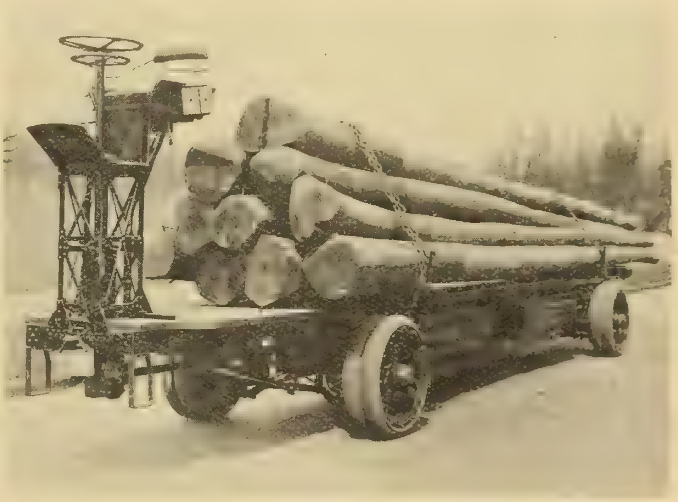
In 1906 Peter Doelger, a prominent New York brewer, had 120 horses, a stable, 200 feet street frontage by 100 feet deep, no less than three wagon yards, a blacksmith shop, and other horse delivery equipment. In 1909 he purchased his first electric truck and later in the same year six more. In 1910 he ordered eighteen more electric trucks. In 1911 he was operating thirty, and these electric trucks are what save him, on the testimony of his own superintendent, $25,000 a year. By July, 1913, this brewer will be operating fifty-two electric trucks and no horses whatever, as they have all been sold. Half of his former stable has been torn down, and a handsome building three storeys high has been erected on the space thus secured, this building being devoted to a bottling plant and shipping room. On the ground formerly devoted to one of his wagon yards he has built a fine garage, 85 feet by 100 feet, two storeys high, with a capacity of forty-eight trucks, or twenty-four to each floor, and he will shortly add two more storeys, thus enabling him to accommodate ninety-six electric trucks.

In addition to the missionary work which central stations all over the country have done to advance the popularity of the electric vehicle, both pleasure and commercial, and to overcome the prejudice that wrong information had given rise to, central stations themselves are finding that the electric vehicle is highly suitable to utilize for their own purpose.

The Philadelphia Electric Company, for instance, is using an electric truck in its distribution of poles. The truck, which is of six tons' capacity and weighs, when unloaded, about 12,000 pounds, has a decided advertising value. The name of the company is conspicuously displayed, as well as the company's motto, "If it is not Electric, it is not Modern." Innumerable questions have been asked regarding the operation of the truck and it has done a great deal to attract the general attention to the use of electric vehicles.

The Commonwealth Edison Company employ seventy-two electric vehicles in every branch of their service and the results obtained have been so satisfactory that this company is contemplating placing in service thirty more, some of which have been ordered already.

The Rochester New York Railway & Light Company has during the past four years motorized its service until it now includes sixty-one electric vehicles. The average mileage of all machines, which are of varying tonnage, is not far from twenty-five miles.



Storage battery truck distributing lighting poles.

Another central station that has been active in the promoting of the use of electric vehicles is the Consolidated Gas Electric Light & Power Company of Baltimore, Md. This company employs twenty-one electrics and has three more ordered, which will shortly be delivered. Two years ago the company had no electric vehicles and now, in addition to its own equipment, it maintains a garage with a capacity of forty-eight machines.

These definite instances of central station progress in the popularizing of electric vehicles are only a few chosen from many that could be cited. They are, however, sufficient to prove that the central stations throughout the United States are thoroughly awake to the possibilities of the "Electric" as a source of revenue, and are putting their shoulders to the wheel gladly in an endeavor to cause the "Electric" to come into its own, as the logical vehicle for city and suburban use.

The Electric Vehicle Association of America is an organization of the central stations and interests the electric vehicle manufacturers and the paper and accessory manufacturers. It conducted a most successful campaign last year in over fifty magazines and trade papers. At the present time the association is soliciting funds preparatory to its second years' campaign, and the number of increased renewals received from its members is eloquent testimony of the success of its first year's publicity.

The situation in Canada, while not so advanced as that in the United States, is showing marked progress in favor of the operation of electric vehicles. In Montreal as against three electric vehicles of all sorts a year ago there are now ten trucks and eighteen pleasure vehicles at the last report. Of the trucks the Montreal Light, Heat & Power Company operate one G. V. 750 lb. capacity; one Lansdowne, 3½ ton; one General Motors, 3½ ton; one General Motors, 2 ton, and one Bailie runabout. The Ogilvie Flour Mills operate a 5-ton Lansdowne; the Toilet Laundry a 2-ton Lansdowne; the Canadian Express Company, two 2-ton and one 1-ton G. V., and the Eugene Phillips Electrical Works one 1250 G. V. truck.

In Toronto the O'Keefe Brewing Company are now using four electric trucks, the Toronto Electric Light Company 2, the Canadian Express Company 3, Robt. Simpson Company 1, The Heintzman Piano Company 1, The Murray-Kay Company 1, and the Langmuir Manufacturing Co. 1. Figures of the number of electric pleasure vehicles are not available but it is probably somewhere in the neighborhood of fifty.

The city of Calgary early in the year placed an order for seven electric trucks with the General Motor Company of Detroit. These are three 5-ton trucks, two 3-ton, and two 1-ton.

Electric Vehicles in B.C.

The number of electric vehicles at present in operation in British Columbia is 118, of this number 100 are pleasure vehicles and the remaining 18 are commercial trucks. Until the present year the sale of electric vehicles in this province had been pushed by agents who handle both gasoline and electric cars. A few months ago the British Columbia Electric Railway Company was awarded an agency for commercial cars, and immediately entered upon a vigorous selling campaign in Vancouver. At the present time the company, besides owning one business car, operates a fleet of five electric trucks in its light and power department.

The first electric truck was sold in Vancouver a little over seven years ago, and despite hard usage, it is to day still in active service. A two-ton truck purchased last year by the Brackman-Ker Milling Company was used in Victoria for a year and gave such satisfaction that this year the company placed an order for one 5-ton truck and one 2-ton truck.

A record was recently kept on the operation of the company's 5-ton truck for 27 days, and it was found that the truck averaged 25 miles per day, the current consumed during this period amounting to 1489 kw. hours.

The B.C. Electric Company is now erecting a garage in Vancouver for commercial trucks, and the rates being offered for storage, etc., are as hereunder:

Capacity of Truck	Garage Charges per month
750 lbs.	$45.00
1,000 lbs.	45.00
2,000 lbs.	55.00
4,000 lbs.	60.00
7,000 lbs.	65.00
10,000 lbs.	70.00

These charges cover storage of car, current as required and charging of batteries, daily washing and oiling, and minor adjustments.

As far as pleasure vehicles are concerned, the private garages take care of this branch of the business, the rates quoted being from $30.00 to $35.00 per month which includes the services mentioned above, in addition to calling for and delivery of cars.

Considerable success is reported by the B. C. Electric Railway Company in its commercial business, the sales put through up till the present being one 2-ton truck to a wholesale grocery house, one 2-ton truck to a hardware merchant, one 1-ton truck to another hardware firm, and one 1-ton truck for use as a hotel bus.

Hamilton as an Electrical Centre

The City of Hamilton has during the past two years made some very important and far-reaching moves. The passing, on July 25th, 1911, of the by-law to raise $505,000 by the ratepayers, placed Hamilton among the Union of Municipalities to use hydro-electric power developed at Niagara Falls and distributed by the Hydro-electric Power Commission of Ontario. This has not only meant a competitive power and light supply for the citizens of Hamilton, but added another large Canadian city to the already extensive list adopting municipal ownership of public utilities. The rate situation is materially improved, whereas cheap power for large consumers was already a prominent feature of Hamilton's industrial progress, the advent of hydro-electric has further lowered this cost and has placed at the disposal of manufacturers and merchants a further power supply both continuous and reliable. Power and light users are probably enjoying the lowest rates of any city on the continent and as the quantity of power purchased by the city governs the price there undoubtedly will be further reductions. Hamilton's geographical position is unsurpassed by any municipality using hydro. Being forty miles nearer the source of supply than any other city of importance demanding a large amount of power the cost is reduced to the city and necessarily to the consumer.

The plans of the Hamilton Hydro-electric Department cover the installation of one main station, centrally located, one west end sub-station and an east end sub-station which is now in operation. The available capacity of these stations will be 8,000 h.p. with a designed capacity of 16,000 h.p. The proposed street lighting system, which will be in operation on July 1st, 1914, is designed for about 1,000 kw. capacity, using 400 ornamental luminous arc lamps constituting a Great White Way on the principal streets of the city, where the purpose of illumination is to create a brilliant effect with the consequent exhilaration which accompanies this condition. The residential districts will be beautifully lighted by 7,000 bracket lights mounted on concrete poles carrying secondary wires.

Throughout the central portion of the city, there will be no poles on the streets, with the exception of those used for trolley wire suspension. This underground system has been designed and provided for in the estimates and will cover seven miles of streets accommodating the C. P. R. and G. N. W. telegraph companies as well as the Hydro and Cataract light, power and traction wires.

Work is progressing very rapidly on the Hydro-electric distributing system. Large sections of the city are already provided with service and by the end of the year hydro power will be available to all residents and power consumers.

The Dominion Power and Transmission Company have made some large extensions during the year. Two large turbine units have been provided for at their Decew Falls generating plant, while the expansion of the Steel Company of Canada at their Hamilton plant adds a very large consumer. An additional transmission line from Decew Falls to Hamilton is also among the proposed extensions. This company is contemplating building a million-dollar steam auxiliary plant. The presence of needle ice at Decew Falls in the winter, resulting in a temporary shutting down of the generators, has induced the company to guard against similar occurrences by making its steam auxiliary capable of producing 30,000 horse-power—sufficient to meet the demands of to-day.

The establishment in Hamilton of the Standard Underground Cable Company of Canada, the Boston Insulated Wire & Cable Company of Canada and the Canadian Porcelain Company places Hamilton with her already large electrical industries, in the first place as an electrical manufacturing centre.

Canadian Crocker-Wheeler Company

The Canadian Crocker-Wheeler Company, Limited, St. Catharines, announce that they have acquired the rights for, and are now supplying in Canada and Newfoundland, the manufactures of the well known continental firm of engineers, Messrs. Brown, Boveri & Company whose pioneer work in the development of both electrical and steam turbine machinery has entitled them to place in the front rank of these industries. The firm of Brown & Boveri was founded in 1891 at Baden, Switzerland. Their products are well known in almost every phase of the electric industry including generators, motors, steam turbines, transformers and switch gears, etc. Within the last few years this firm have placed on the market two lines of particular interest, namely, the phase compensator or advancer and a special type of automatic voltage regulator. They have also done their share in the development of electric railway equipment, and are now building six 2,500 h.p. single phase locomotives for the Lotschberg tunnel service.

Outremont Undergound

Mr. G. M. Gest, of Montreal and New York, has been awarded the tender for the construction of a system of underground conduits for the town of Outremont, P.Q. A twin system will be built, one set being used by the town for the distribution of light and power in the future, and the other set by the Bell Telephone Company. The town originally accepted the tender of Dietrich, Limited, Montreal, the price being $81,000, as against $98,000 asked for by Mr. Gest. This decision was against the recommendation of Dr. L. A. Herdt, the consulting engineer, and of the Bell Telephone Company, who were strongly in favor of Mr. Gest's tender on account of the wide experience Mr. Gest has had in this class of work. On the understanding that Mr. Gest be given the work the Bell Telephone Company agreed to pay 50 per cent. of the cost of $98,000 and 47 per cent. of the extras and costs of re-paving, in addition to the sum of $2,000 to cover engineering expenses and inspections. This was in lieu of 47 per cent. of the total contract originally agreed upon by the company. The Council in accepting the tender of Dietrich, Limited, inserted some stringent provisions into the contract, and Dietrich, Limited, after consideration, withdrew their tender, upon which the council accepted that of Mr. Gest. Mr. Gest has undertaken to construct the conduits in 250 good working days. Altogether, five tenders were sent in for the work.

Saskatoon Developments

Since the first of January, 1913, 249 new light customers and 51 new power companies have been connected up. The total number of consumers to date is 3,979 light and 284 power, making a grand total of 4,263. About 160 new arcs are to be erected in the outlying portions of the city and about 60 5-light ornamental standards, with tungsten lamps, are being erected down town. Three 50 lamp, 2400 volt series d.c. rectifiers, C. G. E. type., are being added.

A by-law was recently passed allowing $150,000 for power house extensions. In this is included a 3,000 kw. turbine which it is hoped to have ready for operation before the end of the present year.

The street railway which was started up at the beginning of the year and which is now under the direct supervision of the city electrical engineer, Mr. Edward Hanson, is now in good working order. The system started out with twelve single truck cars, but these have proven inadequate. By-laws to the amount of $200,000 have been passed for street railway extensions and provision has been made in these for twelve double truck cars. 10,000 feet of the present system is to be double tracked this year, and about 3½ miles of single track will be laid down. This does not include an extension to the neighboring town of Sutherland about 3½ miles out, which is being built privately and handed over to the city, ready for operation.

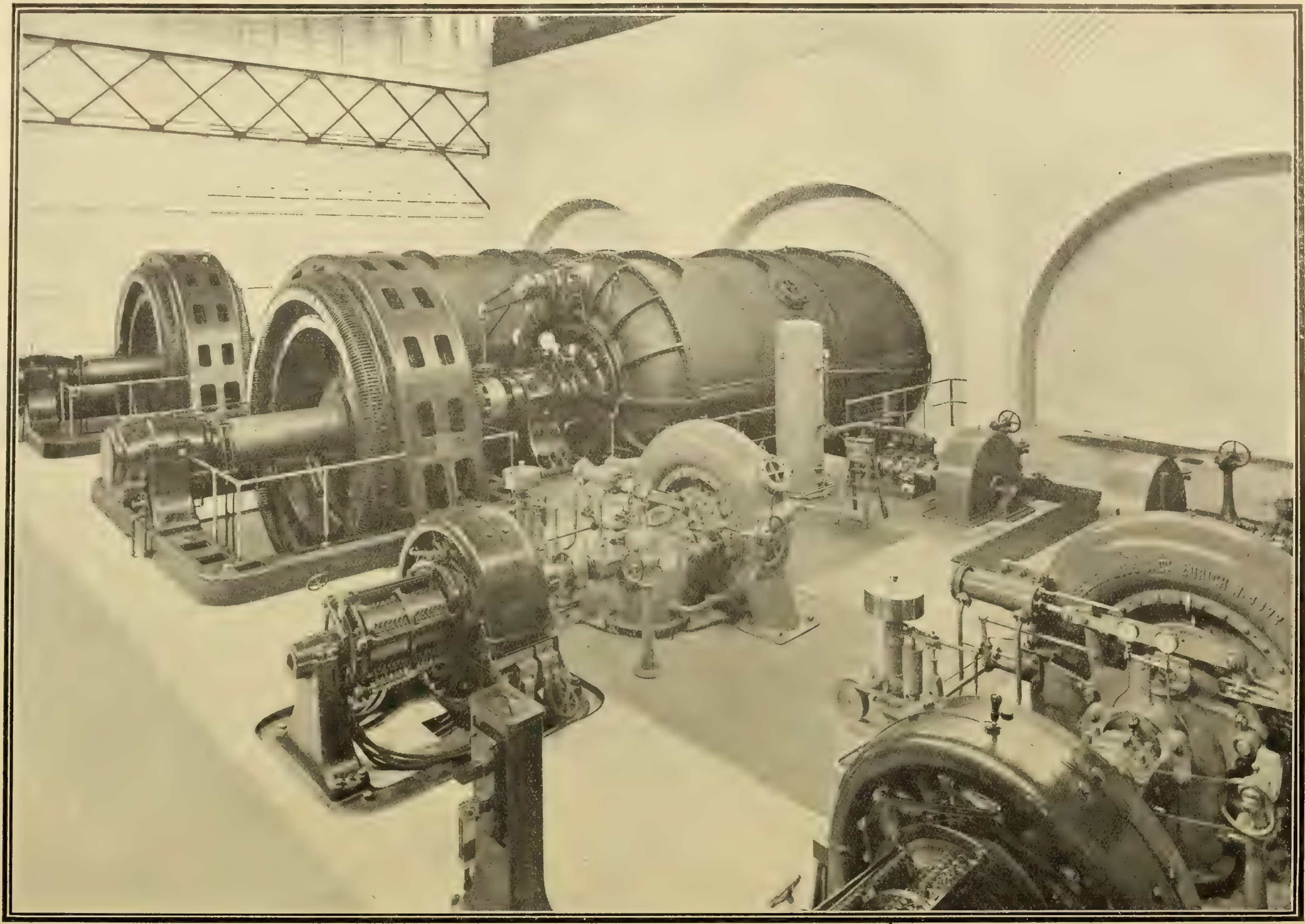
The Halifax Power Company

The Halifax Power Company are planning to develop two sites on the Indian River, 18 miles west of Halifax. The upper station will include two units of 1200 kv.a. each. One operating on 90 ft. head from the Indian River watershed and the other operating on 160 ft. head from the North-East River water-shed; the latter water is carried over to the Indian River by means of a long pipe line. The lower station will include two units of 1200 kv.a. operating on 90 ft. head; in this station the step-up transformers and high-tension gear will be placed.

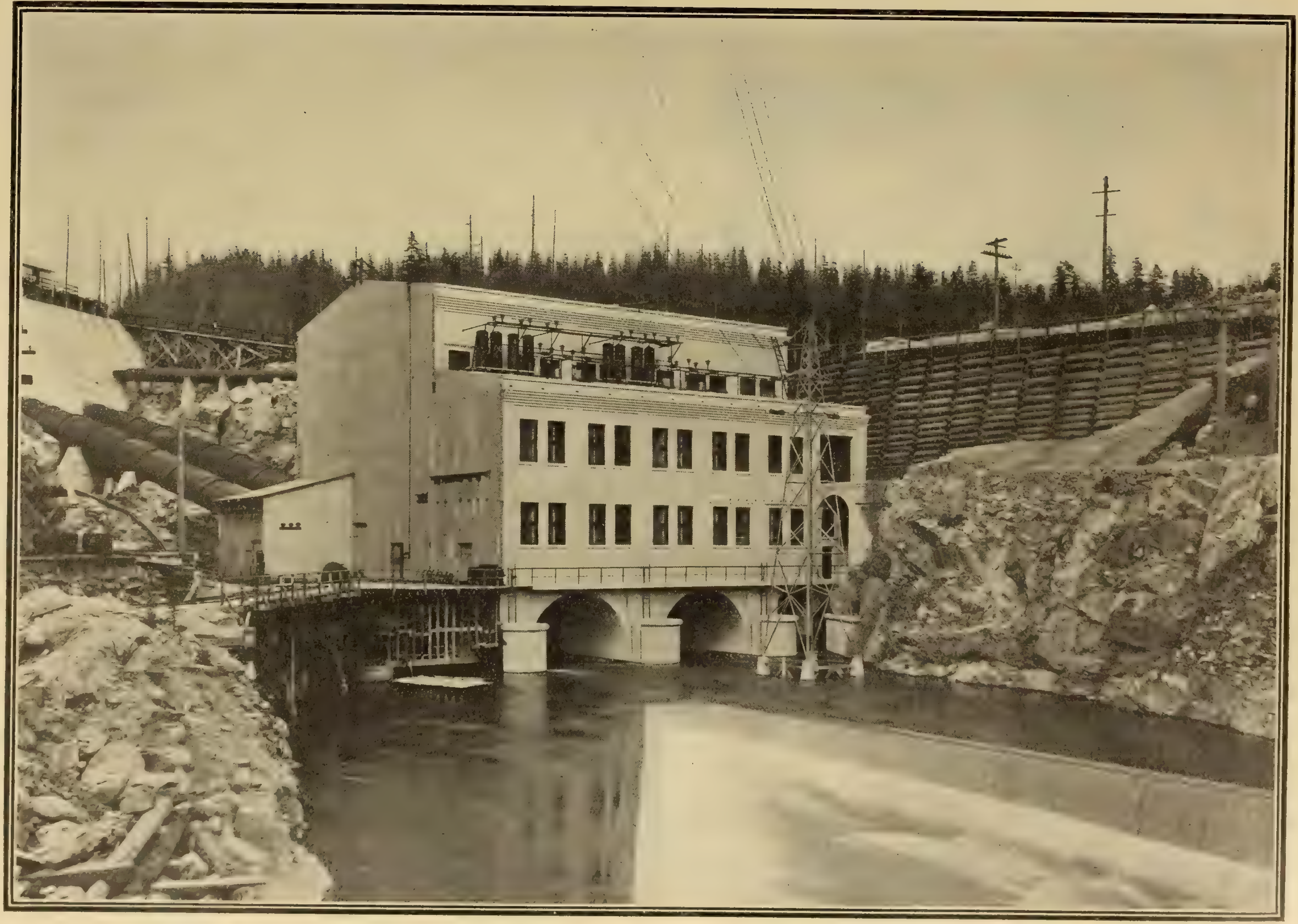
These developments will render 5600 h.p. available in Halifax, which will be carried over a duplicate transmission line by two separate routes. Transmission will be at 33,000 volts. It is the intention of the company to sell this power for lighting and industrial requirements in Halifax. Plans are well under way for the upper development, one transmission line and receiving station, and it is expected that this portion of the work will be proceeded with immediately. Messrs. C. H. & P. H. Mitchell, consulting and supervising engineers, Toronto, have charge of this development.

The Western Canada Power Company

We reproduce herewith some very fine cuts of the generating equipment of the Western Canada Power Company. The power house capacity is now being doubled, which will raise it to 50,000 h.p. A little lower down the river there is a second fall capable of developing another 50,000 h.p. A recent statement of the president, Mr. C. H. Cahan, is to the effect that the demand on this power house will, according to present indications, be approximately 100,000 h.p. by the year 1920. The president also stated that this total capacity of 100,000 h.p. would be made with an actual bonded indebtedness of less than $130 per h.p. including dams, power houses, main transmission lines and power distributing systems. The work and equipment throughout is acknowledged as of the best and entirely in accord with the most approved engineering practice of the present day.



View of interior of power house, Stave Falls—Showing two 13,000 h.p. units, with exciters—Western Canada Power Company



Power House, Stave River—Western Canada Power Co.—The capacity of this power house is being doubled by extending the building to the bank of the river on the left of the picture

Personals

Mr. Henry C. Bentz has resigned as district sales manager of the Northern Electric & Manufacturing Company, Limited, Winnipeg.

Mr. A. L. Woolf, of Winnipeg, western manager for the Canadian Tungsten Lamp Company, recently made an eastern trip, visiting Toronto, Hamilton and Montreal.

Mr. C. C. Clark, of the firm of Kilmer, Pullen & Burnham, Toronto, was married on May 21st, in Montreal, his bride having arrived the day before from England.

Mr. E. A. Schofield, a member of the firm of Jones & Glassco, St. Nicholas Building, Montreal, was married on May 31st to Miss Leonard, daughter of Mr. F. E. Leonard, of the firm of E. Leonard & Sons, Limited, London, Ont. The marriage was celebrated at the Memorial Church, London.

Mr. H. H. Couzens

The newly appointed manager of the Toronto Hydro-electric System, Mr. H. H. Couzens reached the city during the latter week in May, and is now occupying his time in getting into close touch with the various phases of the work before assuming actual management, which he will probably do about the first of July. Mr. Couzens brings to his work the admirable combination of a broad experience at an early age, for though only 35 years old, he already has carried through as varied a programme as falls to the lot of most at a much more advanced stage in life. Among the positions of responsibility which have been held by Mr. Couzens may be mentioned the following: from 1896, when only 19 years of age, he was assistant engineer for the Taunton Corporation and during the year 1897-98 was acting chief assistant. From 1898-99 he was generating station assistant to the Bristol corporation; from 1899-01 mains engineer, Bristol corporation; 1901-09 deputy electrical engineer, Bristol corporation. During the years 1909-12 he was engineer and manager, Westham corporation, and from 1912 up to the time of his resignation to accept the Toronto position he was general manager and engineer of the Hampstead corporation. Mr. Couzens, early in life served a pupilage in mechanical and electrical engineering at Messrs. Allan & Sons, and later in the Taunton Corporation Electricity Department.

Mr. H. H. Couzens

Mr. Lawford Grant

As intimated in our last issue, Mr. Lawford Grant, president and managing director of the Canadian British Insulated Company has resigned that position to associate himself in an important capacity with the Eugene F. Phillips Electric Company of Montreal. For several years Mr. Grant has been a prominent figure in Canadian electrical trade circles and the following items in connection with his early life and training will be of interest. He was born in 1878 and educated at Winchester House, Clifton, Eng. Leaving there, he began his career as an engineer with Mr. Arthur Powell, M.I.C.E., of Bristol, to whom he was articled, but in 1901 Mr. Grant joined the engineering staff of the British Insulated and Helsby Cables, Limited, for whom he carried out many large contracts in various cities of the British Isles during the next few years. In 1905 he was placed in charge of a large contract in the Mediterranean in connection with the electrification of the naval dock yard at Malta, which occupied practically two years. Immediately afterwards his company decided to open a Canadian office and Mr. Grant was appointed general manager for the Dominion. The development of the business has been so marked that it has since been found necessary to organize a Canadian company under the name of the Canadian British Insulated Company, Limited, and since its formation in 1909 Mr. Grant has filled, with exceptional efficiency, the position of president and general manager. Mr. Grant is also well known throughout Canada as the honorary secretary and treasurer for the Dominion of the Institution of Electrical Engineers. He is a member of this society, an associate member of the Canadian Society of Civil Engineers, and an associate of the American Institute of Electrical Engineers. Mr. Grant is also a director of E. M. Sellon & Company, brokerage house, Montreal.

Mr. Lawford Grant

Hydro Development on Severn River

The Hydro-electric Power Commission of Ontario have called for tenders for the construction of a concrete dam and a reinforced concrete power-house at Wasdell's Falls on the Severn River. At this point about 1200 h.p. can be developed at peak load and two 600 h.p. generators will be installed. This plant will serve the Cannington, Beaverton, Sunderland district with power and light.

The Growing Use of Electricity on Farms

No longer a theory—Practical applications in the Trent Valley Canal—Initial expenditures are small, operating costs reasonable

Notwithstanding the phenomenal growth which has characterized manufacturing industries and transportation systems in Canada in recent years, the prosperity of our Dominion as a whole, still is, and must remain fundamentally dependent for its success on our agricultural developments. The Dominion census of 1911 tells of an ever-increasing population of our cities, and, with the exception of the Western provinces, the gradual decrease of the rural populations. This is all the more significant from the fact that the demand for farm products has enormously increased. As a result the farmer is hampered to a very great extent for labor, both on account of the greater attractions and opportunities of the larger centres and on account of the greater demands for supplies made upon him.

It would appear, therefore, that the most modern methods available are not only justifiable, but are an absolute necessity both from an economical point of view as well as from the standpoint of being properly equipped to meet the ever-increasing demand for farm products.

That this has been realized by the farmer to some extent for years past is evidenced by his eagerness to adopt improved machinery, labor-saving devices, and approved methods of cultivation. The introduction of the threshing machine, the self-binder, the latest type of cultivators, mowers, fertilizers, hay tedders, loaders, etc., are recognized as profitable investments and have been generally adopted because successful farming would be impossible without their use. The introduction of the telephone as a method of rapid and general communication was at first considered a luxury, but to-day its use is becoming general, and its value as a necessary auxiliary of modern farm business is best shown by the fact that these instruments, when once installed, are never removed. Through certain sections of the country practically every home has its telephone, and those sections not so served as yet, are being rapidly covered.

Motors Supplant Windmills

The adoption of the windmill by the farmers, as a method of developing energy was one of the first evidences that motive power could be utilized to advantage in many ways around the farm buildings. This one item alone has done much to improve conditions on the farm. At the present time, however, as a result of the intermittent service delivered by this type of prime mover and the increasing demand for power, this class of installation is unable to satisfy the needs of the present day farmer. The gasoline engine, a later introduction, has improved the service, but it possesses many disadvantages in that it is not instantly available, that it will only operate at best a few hours a day, that it is becoming always more expensive to operate, and that it is associated with a considerable amount of fire hazard.

Electricity, on the other hand, is capable of meeting the needs of farm life and of solving the problems of the farmer more completely and at a much more moderate expense than was deemed possible a half dozen years ago. It is instantly available; it is fireproof; it is exceedingly reasonable in first cost and up-keep; operating costs are low; it supplies light in unlimited quantities to every building on the farm and in every corner of every building; it is flexible as a power source in that it is adaptable to a dozen different classes of work around the barns and home.

For some years machinists and electrical manufacturers have been concentrating their efforts with a view to adapting the machine tool and the electric motor to each other, either by belt or direct drive and the developments in this important field of industry may at last be regarded as fairly complete—for there is practically no class of business into which electricity has not made its way as the source of mechanical power.

Electric Lighting

It is now generally recognized that electricity furnishes the safest, cleanest, most effective, and by far the most convenient system of artificial lighting. It is especially valuable for use in farm houses, stables and barns where there is always danger of fire if oil, acetylene or gas lamps are used. Electric lamps require no matches, burn without flame and are entirely safe, there being no danger of fire even if the lamps are broken. From the labor-saving point of view also, it is worthy of note that their use eliminates all the work of filling, cleaning, and trimming oil lamps and the danger of explosion inherent in the use of gasoline lamps. Then, electric lights are the acme of convenience. By the simple turning of a switch light is produced. The switches may be arranged in many different ways so that lamps in any room may be controlled from any point. There is practically no limit to the convenience of control, it being only a matter of a little added expenditure. Electric lamps do not blow out with a draft of air.

Other Uses in the Home

The drudgery inseparably associated with house work on the farm may further be relieved to a very large extent by the introduction of a number of labor-saving devices which the use of electric current renders available. Probably the most practical and most generally used of these devices is the electric iron, by which it is possible at a small expense to do in one hour what, with the old fashioned iron takes two, and to do it much better and with much less expenditure of energy. Among the other safe, sanitary and entirely practicable household equipments may be mentioned a number of electric heating and cooking devices which today are so well constructed as to be practically indestructible and to be free from danger to the operator. These include toasters, tea kettles, soup kettles, coffee percolators, tea urns, chafing dishes, cooking ovens, egg boilers, frying pans, electric stoves and ranges, heating pads, foot warmers, luminous radiators, etc., etc. This apparatus is all practical; the initial cost is reasonable and the operating charges are smaller than generally supposed.

In addition to the above household equipments there are a number of others for which small motors are required. In every case from 1/6 to ½ h.p. is ample. These equipments include coffee grinders, meal grinders, ice cream freezers, motor operated sewing machines, vacuum cleaners, washing machines, wringers, etc. The number of devices to which these small motors are applicable is practically unlimited and their low cost places them within the reach of every one who may be able to find use for them.

Electricity at the Barns and Stables

Nor is electricity any more adaptable to the house than to the stables and barns. Until recent years farmers have had to content themselves with methods for development of power such as the windmill, gasoline engine, tread power, etc., the only use to which electricity has been put in benefitting him being in telephone and telegraph lines. Within the last two or three years, however, developments in the art of distribution and application of electricity have made it possible to meet the requirements of the rural population almost with the same efficiency as the city manufacturer is served. The stables and barns stand to the farmer in much the same relation that the factory does to the city manufacturer, and no manufacturer nowadays considers himself properly equipped for business unless his factory contains all the modern advantages of electric lighting and electric drive. It means a greater initial expenditure to the manufacturer, but experience has taught him that it is money well spent. The same argument is applicable to the farmer. Those who have already installed electric equipment in their buildings are unanimous in their evidence that it is money well invested from every point of view.

As already pointed out the manufacturer and the engineer have been working together to produce an equipment by which they can supply rural districts with light and power at reasonable rates. Improvements in distribution in lighting units and in small motors to give an entirely satisfactory service are the result. It now remains for the distributor to co-operate with the farmer in the installation of this apparatus and that the importance of the situation is being grasped by many municipalities is shown by the number of rural lines being run at the present time at many different points throughout Canada. The Hydro-electric Power Commission of Ontario has done much to arouse interest in this subject, but there are a number of private companies who have been active in carrying out the actual work of supply. One of these is the Electric Power Company, with its numerous subsidiaries operating throughout Central Ontario and more particularly in the Trent Valley district. For years the distribution of electric current along every cross road of this area has been the dream of the Electric Power Company and already much work has been done. This is evidenced by the following list of distribution lines that have been run in the last two or three years, from which light and power is now being supplied to the farmers and others living in these vicinities. We believe, indeed, that this company has done more towards serving rural communities than any other central station in America.

Actual Installations

From Campbellford to Hoard's Station, a distance of twelve miles, a distribution line has been run; from Napanee to Newburg and Cambden East, 10 miles; from Belleville west on the Trent Road, 2 miles; from Brighton to Smithfield, 4 miles; two extensions west from Cobourg between 3 and 4 miles altogether; from Newcastle to Orono, 5 miles; from Oshawa to Harmony to Cedardale, 7 miles; from Oshawa to Whitby, 4 miles; and many other extensions are planned. The total amount of power taken from these lines varies from a minimum of 15 h.p. up to 75 h.p. No service less than 1 h.p. is installed and the average farmer with up to 200 acres of land dequires from 3 to 5 h.p. It is considered by the company that a load of 2 h.p. to the mile is sufficient inducement for the installation of a line and equipment.

The particular class of work to be performed by the motors installed do, of course, regulate their size, but experience in this district has shown that practically every operation can be performed by a 3 h.p. motor. This would do the milking and pumping, operate the separator, pulp the roots, turn the fanning mill and drive a small circular saw. For grinding, however, the mills at present on the market require about a 5 h.p. and this size of motor is also required for wood cutting. Indeed, aside from these two operations a 2 h.p. motor will be found very satisfactory and this size is being installed by most 100 acre farmers.

The motors are not in general placed on a solid foundation, but are mounted on a truck or more often on a wooden frame work provided with handles so that it may be carried from place to place. One motor is therefore capable of being used to operate all the different machines. This plan has been found to work out well.

With respect to lighting, this company allows its customers the privilege of installing the equivalent of ten 16-candle power carbon lamps for every h.p. contracted for, so that the 100 acre farmer who contracts for a 2 h.p. motor to use in his barns and stables is free to install twenty 16-candle power carbon lamps, or, if he chooses, twenty 40-watt tungsten lamps from which he gets about 2½ times more light. This has proven ample, as ten lights in the average farm home and ten around the other buildings will generally be found sufficient to meet the requirements.

The Electric Power Company have done much both by reasonable rates and by their fair and helpful treatment of their customers, to make the use of electric power on the farms in the Trent Valley district general and popular. Every assistance has been given in the purchase and installation of the equipment. No unnecessary frills have been introduced and the policy has been followed at all times of recommending a farmer to take just as much power as it seemed necessary he should have. As in other business transactions the case has often arisen where a farmer could have been induced to install a 5 h.p. motor where a 3 h.p. would do the work, but this policy has been most carefully avoided and the result is that the farmers who have had dealings with this company continue to have confidence that their advice is always given in the interests of the customer. In this way a friendly feeling of mutual benefit has been introduced which it would be well for all operating companies to develop. The farmer as a type, is naturally suspicious of the salesman, but if his confidence is once won he becomes a most excellent advertisement for the further extension of this class of business.

The Rates

The rates given by the Electric Power Company would appear to place electricity within the reach of every farmer who may be fortunate enough to reside in the vicinity of one of their distribution lines. No meters are used, it being taken for granted that the customer will not utilize more than the amount for which he contracts, say one h.p., 2 h.p., 3 h.p. or, as the case may be. For example, if a farmer signs a contract for 2 h.p. he is at liberty to use this amount twenty-four hours of the day, every day of the year, but he is not expected to use more than this amount at any time of the twenty-four hours. That he could easily break this agreement if he were so disposed, is seen by the fact that this customer is allowed to install 2 h.p. in motors and practically the equivalent of 2 h.p. in lighting, so that he is really able to take 4 h.p. off the company's lines. The experience has been, however, that the farmers respect their moral obligations and indeed this is only what anyone would expect from this class of customer.

The rates charged by the Electric Power Company, are $35 per year if only one h.p. is taken; $60 a year for 2 h.p.; $75 a year for 3 h.p., and $25 per h.p. per year for all above 3 h.p. This means, for example, that on a 100 acre farm where an agreement has been signed for 2 h.p. that all the various machines may be driven for one year and the barns and house may be lighted during the same time for an expenditure of $60. This is certainly an exceedingly reasonable amount when it is considered that it not only takes the place of other expenditures, but that it makes it possible to do much more work in the same time, do it better, and further, make it possible to have fewer employees who are often incompetent, generally not congenial, and at best have to be supplied with board and lodging.

The above rates include also the privilege of a number of farmers combining to use their maximum of power in any way. For example, two adjacent farmers who are each contracting for 3 h.p. may purchase a 6 h.p. motor and utilize it at one barn or the other, the only condition being that no other power must be used while this motor is in operation. Or, a number of farmers, say five or six, may club together and buy a 15 or 18 h.p. motor, which will be sufficient to operate a threshing machine.

Exceedingly reasonable rates have been secured by the company for the installation work. It has been found that a 1 h.p. installation including motor, the necessary wiring for the lighting of the house and barns, and the lamps, can be kept within the sum of $110; a 2 h.p. equipment complete $175; and a 3 h.p. equipment $225. For larger installations the expense is only slightly greater. It will be seen, therefore, that the hundred acre farmer can install the necessary equipment for $175 and can operate the same 24 hours of the day every day of the year for an additional $60.

When we consider the amount of money the average farmer spends on implements which are used only a few days of the year, the installation of an electrical equipment such as has been described above, may well appeal to him as a good business proposition quite aside from the luxurious consideration associated with it. A binder costs him $140 and is used five or six days in the whole year. The mowing machine, etc., while less expensive, also operates only very short periods, and yet the progressive farmer knows that his work could not be carried on satisfactorily without these things. A few years ago all of these were considered luxuries, and it is safe to predict that within a very short time electric lighting and electric drive of many of the machines used around the farm buildings will be considered as much a necessity and economy as the self binder is now known to be.

As exemplifying the way the system is working out in actual practice in the Trent Valley district, it may be said that well over fifty farmers are at present reaping the benefits of this company's distribution system. The majority of the farmers in this district own from 100 to 300 acres, the average perhaps being about 200 acres. As an example, we may cite the case of Mr. Alex. Hume, the owner of a fine 200 acre farm who is just completing the installation of 5 h.p. Mr. Hume's house is electric lighted. It is supplied by water through a modern pressure system operated by a ½ h.p. motor. A 5 h.p. motor will do his milking, separating, saw his wood, cut straw, grind grain, etc. Another typical farmer is Mr. Thomas Walker, owning 400 acres and carrying on an extensive dairy business. A 4 h.p. motor has been found satisfactory for his needs, including the operation of the milking machine and the separator. Mr. G. V. Taylor, the owner of 200 acres uses 3 h.p. with which, among other needs, he drives his fanning mill. Thomas Stewart & Sons use a 5 h.p. motor on a 200 acre farm, as does also Jas. Stewart on a farm of the same size.

The Electric Power Company distribute their energy by a two-wire single phase line for the most part at 2400 volts. One of the lines, the longest, carries 6600 and one of the others 4100 volts. In general, each customer is fed from his own transformer which is placed as nearly as possible at the centre of the power distribution system of this particular customer. The company calculates that they can do business on a paying basis if 8 h.p. to the mile is secured.

Relative Merits of Distributing Systems

By Mr. F. T. Stocking

Since the beginning of three-phase alternating distribution little change has been made in distribution systems. It was early found that appartus could be made and lines erected to carry 2000 volts at a cost little in excess of that for lower voltages since the insulation on both apparatus and lines for this voltage was little more than that determined by mechanical considerations. Furthermore, work may be done on these lines while alive with comparatively slight precautions. Higher potentials have been advocated to reduce line losses and the enormous outlay on conductors, but in most instances it has been found advisable to use the 2000 or 2300 volt apparatus for distribution and to put in sufficient distributing stations to keep the cost of lines to a reasonable amount. The principal advance therefore has been in so arranging the standard 2300 volt apparatus as to reduce the cost of distribution to a minimum. For this purpose the 4-wire Y connected system with grounded neutral has been employed and its use is steadily increasing. By this method the transmission voltage is raised from 2300 to about 4000 volts, the potential between any wire and ground being kept at 2300 volts which voltage not infrequently obtained with the delta connected system.

From the victor diagram of a delta connection shown in Fig. 1 it is obvious that 2300 volts will be the potential between any two conductors. In Fig 2 solving the triangle A, B, C, the potential between A and B is $2300\sqrt{3} =$ about 4000 volts which will be the potential between line wires, the potential between each of these and neutral or ground being 2300 volts.

For the same per cent. voltage drop or per cent. power loss the carrying capacity of a given conductor varies as the square of the voltage. The carrying capacity of the "Y" connected system is therefore 3 times that of the "delta." Partly offsetting this great advantage is an increase in cost of line where single-phase loads are supplied since a fourth conductor is necessary. This conductor, however, may usually be of minimum mechanical strength or say No. 6 copper.

Very effective use may be made of this fourth wire by carrying it at the top of the pole and grounding at every third or fifth pole, thereby serving the purpose of a ground wire to lessen the chances of disturbances on the line during thunder storms. For a balanced motor load this fourth conductor may be omitted although if this is done it is advisable to ground the neutral of the apparatus at both the transmitting and the receiving end.

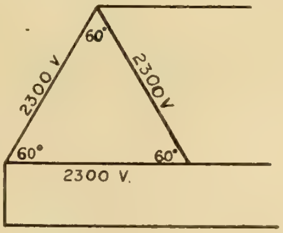


Fig. 1

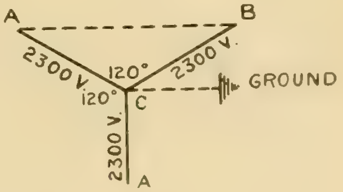


Fig. 2

Other disadvantages are an increase of 10 to 30 per cent. in meter costs; 10 per cent to 20 per cent. in the cost of motors for use on line voltage, and frequently an increase in cost of switching and protective apparatus. Greater care is also necessary in keeping the line clear of accidental grounds since a ground that would not seriously affect a delta system might result in a short circuit where a grounded neutral is employed.

Considering a lighting load only, the cost of line will be the chief factor in selecting the system. Assuming 5 per cent.

as the maximum allowable potential drop a single-phase 2300 volt line of minimum size—i.e. No. 6 copper—will carry a load at 100 per cent. power factor of about 80 h.p. a distance of 1 mile. A 3-phase, 2300 volt line will carry twice this or 160 h.p., while a "Y" connected 4000 volt system will carry 6 times the first or 480 h.p.

With a water power plant having a day peak it will not be necessary to consider power losses on the lighting circuits, hence the system to employ, and the size of conductors, may be determined from the regulation required. When, however, the line losses mean a direct increase in the cost of power such losses should be reduced to a point where the annual cost of same about equals the annual charges on conductors erected since the total annual cost is then reduced to a minimum. Considerable judgment is often required in deciding just what the load for the year and the resulting annual losses will be.

Assuming the cost of power at the station as $25 per h.p. per year, the cost of conductor erected as $0.26 per lb., with interest at 6 per cent. and depreciation on conductors as 2 per cent. the economical load at 100 per cent. p.f. for No. 6 weatherproof copper with a single-phase 2300 volt line may be found as follows:—Cost, erected, of 1 mile of two No. 6 T.B. weatherproof copper conductors would be $310. Annual charges at 8 per cent. = $24.80, which would be equivalent to the cost of

$$\frac{24.80}{25} = .992 \text{ h.p.} = 740 \text{ watts}$$

for line loss.

The resistance of 1 mile of No. 6 copper single-phase line is about 4.18 ohms and watts loss = C^2R,

$$\text{therefore } C = \frac{\sqrt{740}}{\sqrt{4.18}} = 13.3 \text{ amperes which at 2300 volts} =$$

about 41 h.p. Similarly it may be found that economical load for a 3-phase line of No. 6 copper and 2300 volts is about 71 h.p. and for a four-wire, 4,000 volt line is about 143 h.p. In the following table are given the annual costs per mile, including line costs and losses, of transmitting various loads with different systems. Prices of material and of power are as assumed above. In the 4,000 volt system is included the cost of the neutral with its support erected and wire grounded at every fourth pole, the neutral wire in all cases being No. 6 triple braid weatherproof copper. Prices do not include the cost of poles, cross arms, etc., as these are practically constant for all three systems.

Size Copper	No. 6			No. 2			No. 2/O		
Volts	2300	2300	4000	2300	2300	4000	2300	2300	4000
Number of Wires	2	3	4	2	3	4	2	3	4
Annual Charge on Conductors..	31.00	46	67	72	108	129	140	210	231
H.P. carried 1 mile with 5% volts drop	60	120	360	150	300	900	285	570	1710

H.P.	ANNUAL COST PER MILE PER H.P.								
	No. 6			No. 2			No. 2/O		
20	1.84	2.45	3.40	3.71	5.45	6.47	7.05	10.50	11.55
40	1.36	1.45	1.75	2.04	2.82	3.26	3.62	5.32	5.80
60	1.40	1.21	1.27	1.55	1.97	2.21	2.52	3.60	3.88
100	1.70	.75	.91	1.30	1.37	1.39	1.70	2.25	2.35
150	1.70	1.41	.81	1.36	1.16	1.01	1.37	1.62	1.61
200	3.10	1.70	.82	1.53	1.13	.84	1.29	1.34	1.25
300	—	2.36	.96	1.99	1.23	.72	1.34	1.14	.92
500	—	3.77	1.35	3.41	1.67	.74	1.74	.95	.70
1000					3.03	1.09		1.67	.71

Under the conditions assumed above it would be uneconomical to use a single-phase system for transmitting more than about 50 h.p. For loads over 100 h.p. it would appear advisable to employ the "Y" connected system and this would doubtless be true for lighting loads since only the metering and switching apparatus at the station would be affected causing only a slight additional cost, while two station transformers would still be effective if the third were damaged. The regulation also would be very much improved which in itself is an important consideration.

Where a motor load is carried, owing to the lower power factor and the resultant increased line losses it will be economical to use the 4-wire system—on somewhat lighter loads —considering transmission only. If the motors are to be supplied at voltages lower than 2000 this may hold, but where they are to be connected directly to the line the increased cost of motors, starting devices and meters will lessen or perhaps entirely overbalance the saving on transmission.

The increase in cost in motors with starting devices is due largely to the latter, although, no doubt, the increase is to a great extent caused by the fact that 4000 volt apparatus has not become a standard in Canada.

In the switching apparatus to handle the same load there should be little difference in price as the neutral wire may be permanently grounded at the load and there is no necessity of breaking it, hence the ordinary 3-pole oil switch may be employed.

In meters, however, working on unbalanced loads using the fourth wire there is a considerable difference in cost since three current transformers are required in place of the two as ordinarily used. Assuming the total cost of meters both for the station and the customer as $2 per h.p., with annual charges of 14 per cent., and of motors with starting devices as $13 per h.p. with 12 per cent. annual charges, station switching and protective apparatus $2.50 per h.p. with 12 per cent. annual charges; then an increase of 30 per cent. in cost of meters, 20 per cent. in motors and 20 per cent. in station protective and switching apparatus will increase the annual cost by .08 + .31 + .06 = $0.45 per h.p.

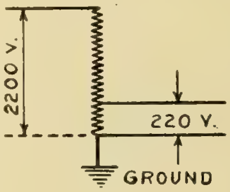


Fig. 3

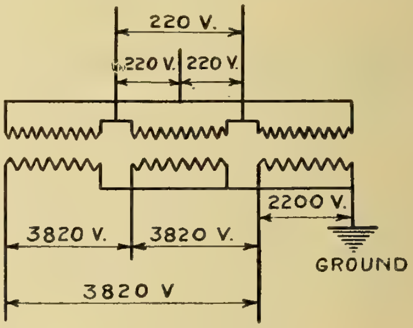


Fig. 4

Again when a "delta" system is adopted two transformers will still be effective for supplying 3-phase current after the third has been damaged which is not the case with the "Y" connected system and for this reason it may be advisable to install a spare transformer. Assuming the cost of transformer installed as $12 per h.p., then the annual charges for the spare taken at 12 per cent. per annum, will increase the annual cost per h.p. by $0.48, bringing the total extra cost above that of the delta system up to about $0.93 per h.p. per annum. This figure should cover the additional cost in the most unfavorable case and usually this cost may be made much less.

Two or more 3-phase transformers may be substituted for the bank of three single-phase transformers bringing the cost down to little in excess of the latter and making the service fully as good. In many small stations the motor load is of such a nature that an interruption of one or two days would not be serious and therefore would not necessitate spare transformers or the whole system could be changed temporarily to V. On these stations the motor loads are small and are usually supplied at a potential lower than that of the line. In such cases no additional equipment is required at the motor, the only additional cost being in station switching and meter equipment. The additional cost here would probably not exceed $0.15 per h.p. per annum.

Generally speaking for a mixed load where regulation is not a factor it would be quite safe to install the "Y" connected system when the annual saving on transmission costs reaches $0.50 per h.p. On the longer lines where it is necessary to consider regulation it would doubtless be wise to use the "Y" system on much lighter loads than would appear from an examination of the above figures.

In connection with this system various engineers have advocated the use of auto transformers for service use as shown in Fig. 3. This would considerably reduce the transformer costs and should not be objectionable providing a good ground is assured. Some companies have even discarded the neutral wire and depend entirely on the ground wire for single-phase work. This would, however, become dangerous unless it is known that one side of the secondary is permanently and absolutely grounded. Fig. 4 indicates a common method of connecting transformers with "delta" primary to "Y" secondary or vice versa. Some care must be taken in making such connections since it is possible to obtain unequal potentials between the different secondary wires, and it is advisable to test with a volt meter or lamp bank before connecting to load. For supplying a motor load from two transformers the connection shown in Fig. 5 is used and may be employed either on light loads to save transformer costs or as a substitute for three transformers in case one is damaged.

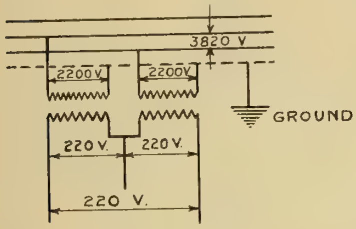


Fig. 5

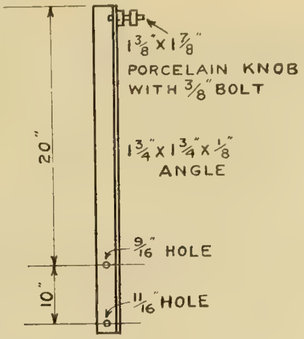

$1\frac{3}{8}$" x $1\frac{7}{8}$"
PORCELAIN KNOB WITH 3/8" BOLT
20"
$1\frac{3}{4}$" x $1\frac{3}{4}$" x 1/8"
ANGLE
9/16" HOLE
10"
11/16" HOLE

Fig. 6

The question of what form of conductor to use for the neutral wire and how this conductor should be supported is one that requires considerable thought. With the lighter loads since little current is carried, mechanical strength is the chief consideration. For such cases copper clad steel and even galvanized iron has been proposed and would no doubt serve quite well on such loads particularly when grounded at frequent intervals. Its chief use in such cases would really be to assure an absolute ground and, when properly erected, to answer as lightning protection.

Whether or not this neutral wire should be insulated would depend upon its position on the pole as well as on the type of the other conductors. If the latter are bare the neutral would naturally be. If the neutral is located close to insulated primary conductors where linemen are liable to come in contact with it while working on live lines it is advisable to have the neutral insulated. This also applies to the grounding wires. If the neutral can be supported in a more or less isolated position such as well above the upper arm there appears no necessity of insulating it and the saving on cost of insulation may be used in raising it still higher thereby making it more effective as a lightning protection. Various types of pole top brackets are on the market and serve nicely in cases where the arm can be placed well down on the pole. A short heavy porcelain knob secured by a lag screw to the top of pole also answers well, the porcelain being the cheapest article obtainable with smooth surfaces which will not injure the wire. Where an iron wire is employed as neutral an iron clamp may be substituted for the knob.

For carrying the neutral well above the top of pole an angle iron fitted with a porcelain knob, as shown in Fig. 6, is probably the simplest device that can be made. The through bolt for supporting the cross arm may be used as the lower bolt for this support, thereby saving a bolt and two washers. In using such a device it is advisable to carry the neutral on an insulator of some description to avoid danger to linemen. For the same reason the grounding wire should be carried up without touching this suport.

There is, of course, no necessity of using special construction for this neutral wire, the only object of carrying it at the top being to have it serve as a protection which might considerably improve the service and at the same time make it possible to discard at least a portion of the lightning arresters.

Wireless Stations on Hudson Bay Railway

Under a contract between the Marconi Company of Canada and the Federal Government, two wireless stations will be erected at the terminals of the proposed Hudson Bay Railway—one at Port Nelson on the Hudson Bay, the northern terminal of the line, and the other at Le Pas, Manitoba, the connecting point of the new line with the Government railway system. These stations are primarily intended to serve as intermediaries for the ordering and forwarding of material and labor from the base to the scene of operations, and will greatly facilitate the work of construction. The stations will be of 10 kw. capacity, the power being obtained from 20 h.p. Canadian Fairbanks-Morse engines, and each station will have a range of 500 miles. It is probable that the stations may form the commencement of a wireless chain extending through northern Ontario and Quebec and the Hudson Bay straits, eventually linking up with the Newfoundland Government stations on the Labrador coast.

Convention Rejuvenation

When it was definitely decided to hold the Canadian Electrical Association Convention in Toronto, the Jovians immediately began to prepare for a rejuvenation to take place on one of the convention dates. The necessary arrangements have been made and the committees are at work perfecting the details for this gala event, which will take place on June 27th at 8 o'clock. All Jovians are invited to attend, and members of the C. E. A. who are not Jovians are advised that they can obtain application blanks and the necessary information from any member of the Toronto managing committee, consisting of E. B. Pike, H. G. Nicholls, M. P. Ellis, W. W. Lovell, S. C. DeWitt, B. O. Salter, Jno. Ward, secretary and treasurer, and A. Ross Oborne, chairman of the membership committee. The Jovian order in Toronto have issued an attractive folder calling attention to this rejuvenation. They point out that there are to-day over 10,000 members of this order, and that their worthy slogan "all together, all the time, for everything electrical," should appeal strongly to all good men in the electrical business.

Mr. Irving Smith, 809 Unity Building, Montreal, has secured the agency, for Canada, for the Delta-Star Electric Company, of Chicago, manufacturers of high voltage disconnecting switches and high voltage disconnecting gear and fuses.

The Makers of Electrical Canada

COL. SIR HENRY MILL PELLATT, C.V.O.

A man may be known in military circles as a soldier of renown and as a generous patron of the military arts; he may be a financier with world-wide reputation for wisdom in council and honor in all his dealings; he may be the holder of athletic records and have made a mile in faster time than any other athlete on his continent—but any one of these takes second place to the man who advances, not one stage, but many, the universal utilization of electricity by showing how it may best be developed, demonstrating its commercial possibilities and backing his faith by a final demonstration that eclipses anything the world has seen. And what then of one man who combines all these qualities. This is Col. Sir Henry Pellatt, C.V.O., the subject of this issue's sketch and a true maker of electrical Canada.

It is not generally known to the younger generation that in 1879 the then "Harry" Pellatt was the fastest "miler" on the continent of North America winning the title by defeating Duffy in 4.32, the fastest time on record, with one exception, to that date. Previous to this Sir Henry had been champion athlete of the Toronto Model School, in 1875, and of Upper Canada College in 1876. A little later he also won special mention as a member of the first team of the Toronto Lacrosse Club. Even yet Sir Henry is said by those who know him intimately to be as "hard as nails," the result not only of his early training, but also of an hour spent, even yet, each morning in his own gymnasium.

In military matters Sir Henry's achievements, having been more recent, are more widely known. In his youth he became a private in the Queen's Own Rifles, the largest volunteer corps in the Dominion, with which regiment he has since been continuously and prominently associated, retiring but recently with the rank of Colonel. In 1897 it will be remembered that he commanded a section of the Canadian contingent which visited England on the occasion of the Queen's jubilee. Later, at the Coronation of King Edward he received command of the Canadian contingent and took with him, at his own expense, the Queen's Own bugle band. In 1910 he again, at his own expense, took his whole regiment of over 600 men to England to take part in the manoeuvres of the British army at Aldershot. It was for his military achievements, to which he was chiefly impelled by strong imperialistic convictions, that he probably owes, more than to any other single phase of his life's work, the honor of receiving, in 1905, recognition for his services in the title of Knight Bachelor.

Sir Henry M. Pellatt.

Sir Henry began his financial career in the brokerage office of his father, the senior member of the then firm of Pellatt and Osler, the other member of the firm being Sir Edmund Osler, M.P. In 1882 this firm was dissolved and the business has since been carried on under the time-honored name of Pellatt and Pellatt, of which Sir Henry, since 1891, is the senior member. But his broker's office can scarcely, especially in recent years, have received any large proportion of his time, which has been occupied in the development of many industrial and other enterprises, in which he has interested himself for the building up of Canada. For example, aside from electrical companies about which we shall speak later, he is connected in one capacity or another with the Dominion Steel Corporation, the Richelieu & Ontario Navigation Company, the British & Colonial Land & Securities Company, the British Canadian Shipbuilding & Dock Company, Steel & Radiation, Limited, the British Columbia Packers Association, etc. To these he gives freely of his time, ability and sagacity, and it is noticeable that success attends the enterprises he associates himself with.

But above all these is Sir Henry's interest in matters electrical. He it was who was largely instrumental in the erection of that pioneer, but still unexcelled, hydro-electric development at Niagara Falls, the Electrical Development Company's plant. This was followed by the Toronto & Niagara Power Company, a transmitting company which placed Toronto for the first time in the limelight of Niagara's incandescence. The Toronto Electric Light Company for the distribution of light and power was the natural sequence and of all three, Sir Henry Pellatt became and remains president. Indeed Sir Henry has been prominent in the councils of most of the big electrical successes of the past decade including Twin City, Toronto Railway, Sao Paulo, the reorganized Toronto Power Company and the latest development, the Brazilian Traction Light & Power Company. He has had faith in electricity, and has demonstrated his faith in a practical, tangible way by staking both his reputation and his fortune in its developments. Of his latest and crowning achievement, an installation of electrical equipments in his own new mansion which, so far as we can learn, will stand without a parallel the whole world over, we speak at length in other pages of this issue. Sir Henry was born in Kingston, Ont., in 1860.

The magnificent mansion of Colonel Sir Henry M. Pellatt, Davenport road and Spadina avenue.

The Electrical Equipment of "Casa Loma"

The magnificent new mansion of Col. Sir Henry M. Pellatt—An intricacy and refinement of electrical control without a parallel in the world.

The palace of Col. Sir Henry M. Pellatt, occupying, with grounds, some 15 acres on a commanding eminence at Davenport Road and Spadina Avenue, Toronto, and now nearing completion, is undoubtedly a masterpiece of architectural design and beauty, but is still more interesting from our point of view, in that the electrical installation represents the most complete and thorough adaptation of all the electric arts to a private residence that the world has seen. And in this statement we are not unmindful of the magnificent luxury of the Astors, Vanderbilts, Clarkes, Schwabs and Carnegies of our neighbors to the south. In point of clever and intricate refinement of control, completeness, practicability and magnificence the electrical installation in Sir Henry Pellatt's mansion will be without a peer in the whole world. This has been the avowed ambition of the owner. Sir Henry is a man deeply interested in the progress of electricity and takes a keen delight in its triumphs, and there is no doubt that this installation will long remain an outstanding monument to the possibilities of the industry he has done so much to promote.

Some conception of the ideal in the mind of the owner of this beautiful mansion may be gathered from the accompanying views of the exterior of the buildings, but undoubtedly the climax of engineering skill has been reached in the intricacies and magnitude of the electrical equipments, which in point of size are such as would be installed in a large town or small city. The number of lamps required in all will be between four and five thousand 50-watt unit equivalents which, with motor installations and heating units, will bring the maximum requirements into the neighborhood of 400 kw.

A brief mention of a few points of special interest in connection with this installation will serve to give the reader some conception of the scale on which the work has been carried out:—Current will be transformed within the mansion from 4,000 volts to 550, 220 and 110 volts and distributed at either 25 cycles or 60 cycles as desired. A main switchboard of 11 panels, a distributing switchboard 35 ft. long by 8 ft. high, and a dimming machine will, on account of their size, occupy separate rooms. The distributing board will be of the finest Italian marble, and will be housed in a room walled and ceilinged of the same; this board will be operated by remote control only. The lighting requirements of the mansion will be fed by 150 1-in. conduits containing three circuits each on the average; or a total of 450 circuits. The lamps will be controlled by selector switches, generally 13 point. At four different locations in the mansion every light in and around the buildings will be under the control of one master push button. Thirteen master-selector boards operate 128 dimmer control circuits. Eighty-four picture dimmer switches control the art galleries. The cables for the control and dimming equipments will be carried in upwards of 100 2-in. conduit, and for the most part will be 75-wire cables. Finally, the telephone system will consist of 32 sets connected by four trunk lines with a central city exchange.

In the following article these various points of interest will be described at greater length and in detail.

Transformers

The incoming main is a 4000/2300 volt, four wire, 3-phase, 25 cycle line. One 150 kw. 2300/125 volt, 25 cycle unit will supply current for lighting. One 150 kw. 4000/550 volt, 3-phase, 25 cycle unit will supply current for motors throughout the main building, and one 40 kw. 4000/220 two-phase, 25 cycle transformer will supply the motors in the stables, conservatory, etc. In addition to the transformers there will be a 150 kw. 2300/125/250, 25/60 cycle frequency changer set so that when required the mansion may be lighted with 60 cycle current. In this same room will also be installed duplicate sets of 25 kw. 20 volt motor generators for the control of the relays and the call-bell system throughout the building. There will be no batteries installed. The motor generator sets will be so equipped that should one fail to operate, the second one will be cut in automatically.

Main Switchboard

The main switchboard will be of blue Vermont marble mounted on an angle iron frame, and will consist of eleven panels to be used as indicated below. A swing bracket will carry a voltmeter for the incoming line; a voltmeter for 3-phase, 550 volt power; a voltmeter for 2-phase, 110-220 volt light; and a frequency indicator.

Panel No. 1 will be used for the incoming line and be provided with a 100 amp. oil switch with time limit relay; a 300 kw. watt-hour meter; three ammeters; potential receptacles; and four single-pole disconnecting switches.

Panel No. 2 is the lighting transformer panel controlling 4000/2300 to 125/250 volt, 2-phase, 25 cycle current. It will be provided with a 100 amp. single pole oil switch; three ammeters; potential indicator; and four disconnecting switches.

Panel No. 3 will be used for controlling the current for opening and closing the coils of automatic switches on the distribution board. There will be two circuit breakers mounted on this panel electrically interlocked, so that one breaker will automatically close if the other breaker opens and thus insure a perpetual supply of current for the operation of the automatics.

Panel No. 4 will be used as a lighting transfer panel, and will be provided with two solenoid control interlocked circuit breakers, so arranged that the breaker connected to the 60 cycle frequency changer set will close as soon as the frequency changer has come up to full voltage, and at the same time will open the circuit breaker furnishing 25 cycle current for the lighting system of the house.

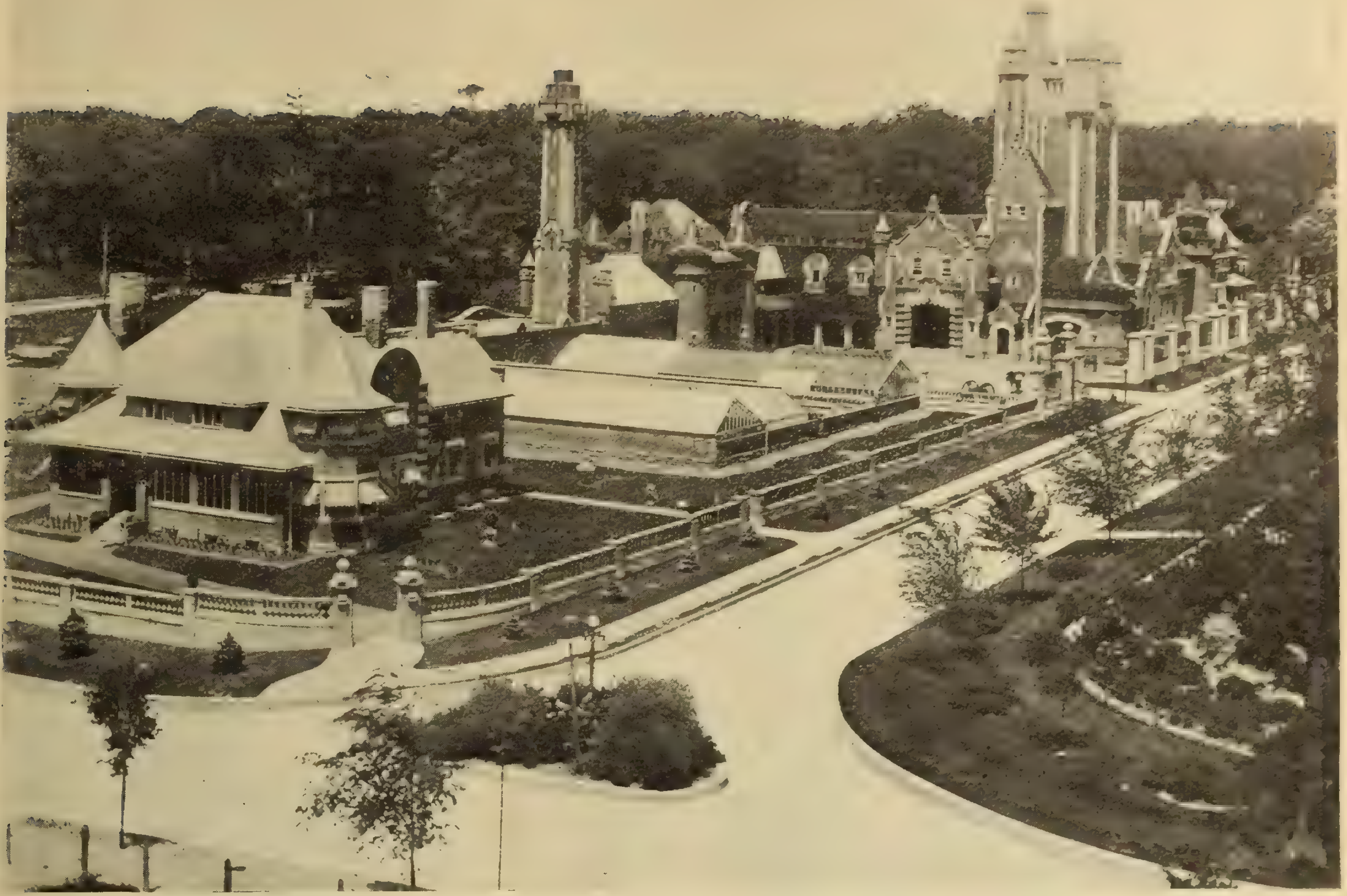
Panel No. 5 is a frequency changer panel to change from 25 to 60 cycles, and will be provided with an oil-switch with time-limit relay, potential receptacle, three ammeters, and one field ammeter for generator.

Panel No. 6 is the general power transformer panel and takes care of the 150 kw., 500 volt, 3-phase power transformer. It is provided with automatic oil switch; time limit relay; three ammeters; potential receptacle and disconnecting switches on the 4000 volt line.

Panels 7 and 8 are power feeder panels and are provided with over-load and no-voltage automatic circuit breakers for the control of motors, elevator, refrigerator, laundries, circulating pump, sump, dumb waiters, and two remote control over-load and no-voltage contactors for exhaust fans.

Panel No. 9 is the motor control panel for the two 20-volt motor-generators and is provided with two motor starters for starting the 550 volt motors directly connected to the 20 volt generators.

Panels 10 and 11 are for the control of the 20 volt generators. Each is provided with an ammeter, voltmeter, rheostat, disconnecting switch and double pole solenoid operated circuit breaker. The two breakers for the two generators are so interlocked with the motor starters on panel No. 9



View showing lodge, conservatories, stables and a corner of the garden.

that the opening of either of the breakers will open the motor starter on the corresponding motor and close the motor starter on the other motor so that there will be an uninterrupted supply of 20 volt d.c. current for the operation of relays which are controlled by the master and the grand-master boards located in different parts of the building.

The Conduit System

The lighting wires will be carried in something over 150 1-in. conduits to the different parts of the mansion. Leaving the distributing board 100 of these conduits lead upwards to the ceiling of the main hall and pass, 75 to the east and 25 to the west side of the building. One of the photographs reproduced herewith shows a view of the ceiling of the main hall during construction. Each conduit encloses three circuits for the most part, though occasionally four are installed. The 100 conduits are distributed as follows: 10 lead to the library, 7 to the dining room, 11 to the palm room, 5 to the main corridor, 14 to the lower picture gallery in the main hall, 11 to the servants' quarters, 12 to bedrooms on the second floor; these are all for lighting purposes. Five others will carry power wires, one to the refrigerator motor, one to the circulating pump for the plunge bath, one to the laundry machinery, one for heating appliances in the kitchen and one for heating appliances in the butler's pantry. The motors are all 550 volt type. The heating currents are 110 volts.

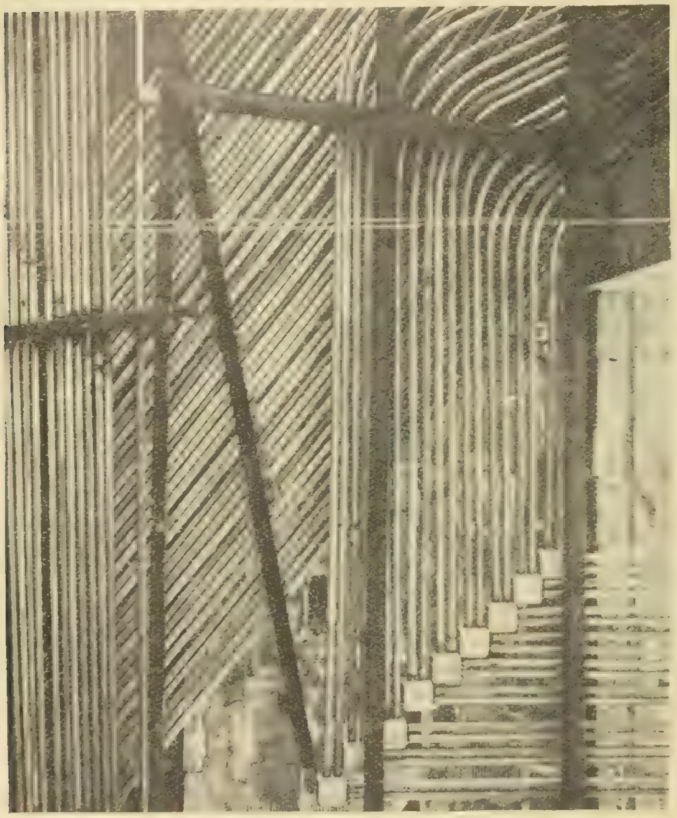
The 25 conduits running westward from the main hall carry wires for lighting as follows: 8 to the drawing room, 5 to the smoking and billiard room, 6 to three suites on the second floor and 5 for the grand staircase and great hall.

The conduits which carry wires for the basement lighting are distributed, two for the plunge bath lights, one for the gymnasium, two for the bowling and recreation rooms, one for basement billiard room, one for transformer room lighting, two for basement corridor and staircase, one for corridor leading to tunnel, four for lighting the 3rd floor, four for lighting the five ceiling fixtures in the great hall and three for pictures and corridor lighting on the second floor. Two conduits are also installed for the supply of 550 volt current for the pipe organ motors and two more for the exhaust fans.

Cables

The conduit service described above includes only the lighting and power equipment, but a large number of cables mostly enclosed in 2-in. conduits will be installed to control the dimming and momentary switches. For the most part the cables are 75-wire but the complete list with the function each fulfils, is as follows:—One 75-wire cable leads to the palm room for the control and dimming of 400 lights at that point. One 75-wire cable controls the dining room in a similar way; one 75 wire cable controls the library; one 75-wire cable controls the drawing room; 42 75-wire cables control as many individual pictures in the main art corridor; 42 75-wire cables will control similarly the upper art gallery; one 30-wire cable will control the dimming of the ceiling lights in the main art corridor; one 75-wire cable controls the upper main corridor and the grand staircase; two 50-wire cables control the great hall and entrance; one 30-wire cable controls the balcony and terrace; two 5-wire cables control the exhaust fans. The grand-master boards will also require four 75-wire cables for the control of all the lights in the mansion and grounds. These will be placed as follows:—One in Sir Henry's chambers, one in Lady Pellatt's boudoir, one in the main entrance and one in the servants' quarters.

No. 18 wire is used for the control system throughout. No. 12 for the lighting and No. 10 for the power circuits. The conduit for the distribution system was supplied by the Conduits Company, Limited, of Toronto. The condulets, cable, transformers, frequency charger set and two 20-volt motor generator sets are being supplied by the Canadian General Electric Company. The installation of the distribution system is being carried out under the immediate supervision of Mr. J. E. Curran. The distribution switchboard and its functions are described in detail below.



Ceiling view in main hall showing some of the conduits containing lighting wires.

Distribution

The lights throughout the mansion will be controlled by thirteen master-selector boards. Each of these boards is provided with a 15-point dimmer switch, a master switch and selector switches.

The dimmer switch is a specially designed 15-point equipment so arranged that by turning the handle of the switch to a point indicating the desired shade of lights the dimmer will automatically produce the desired shade.

The master switch is for the purpose of controlling the lights collectively while the selector switches are for the purpose of controlling the lights individually. Each of the selector switches is provided with an indicating lamp.

These master boards are very compact, being about 5-in. wide by 15-in. high for a board of about 20 selector switches, a dimmer switch and a master switch. The master and selector switches, however, are independent of one another. Many of the circuits throughout the house are controlled by more than one master board. To close or open the circuits individually, press the "on" or "off" button of the selector switches. To close or open the circuits collectively press the "on" or "off" button of the master switches.

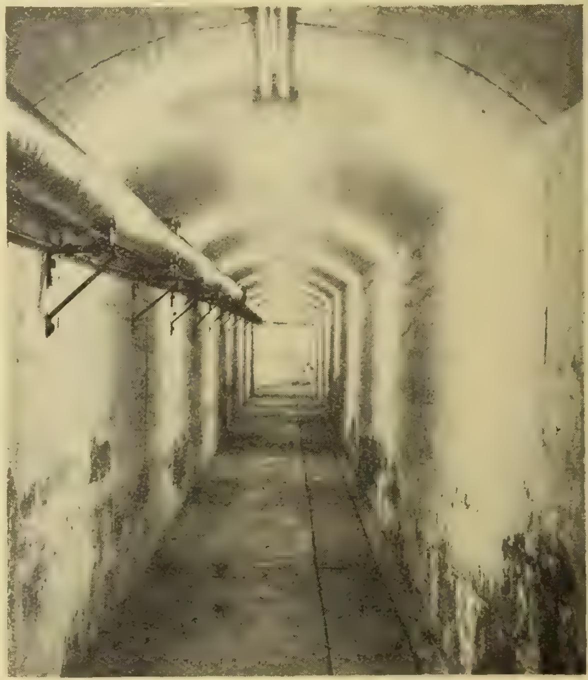
In addition to the master boards there is an emergency system of lighting. Grand-master selector boards for emergency lighting are installed in four different parts of the building. These boards are independent of the master-selector boards and each of them has one master switch, one dimmer switch and 25 grand-selector switches, each with an indicating lamp. This emergency system is for the purpose of making it possible to turn the lights on in every part and room of the building as well as in the standards on the grounds and the boulevard lights, no matter whether the switches controlling the circuits are in the "on" or "off" position or whether the lights are controlled by automatics or plain circuit switches. Every room of the building will be lighted in full by pressing the "on" button of the grand-master switch of any one of the four grand-master boards. All lights dimmed at the time the grand-master system is used will be turned on to full brightness by pressing the "on" button of the dimmer switch.

The grand-selector buttons will light only certain rooms or sections of the building. The grand-master switch will control most of the circuits, controlled by the grand-master boards, while the grand-selector switches will control certain circuits of each of the master boards. Further, while the turning "on" of the grand-master or grand-selector switches will turn on all lights not already lit, the turning "off" of the grand-master or grand-selector switches will not turn off any lights which were on at the time the grand-master or grand-selector switches were operated.

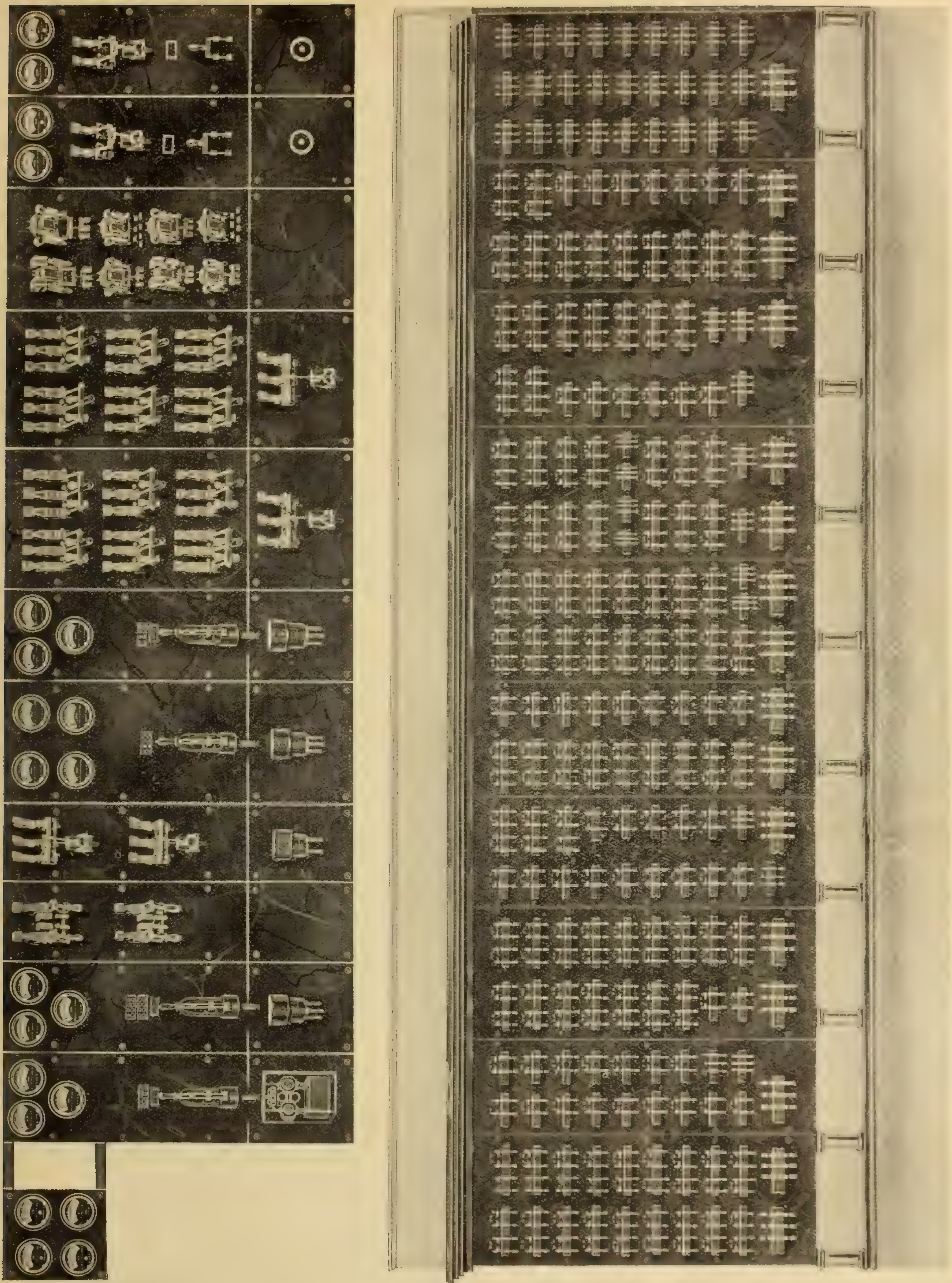
The master-selector as well as grand-master selector boards are connected to relays which operate the automatic switches located in the distribution switchboard room.

Distributing Switchboard

The piece of equipment in this whole installation which stands out pre-eminently is the distributing switchboard and the room in which it is being installed. The switchboard will be of the very finest grade of Italian marble known as Blanco P. This is the most beautiful marble in the world, very hard and of uniform color, being slightly creamy in shade. The board when full extended as shown herewith measures 35 ft. x 8 ft. It will be installed along three sides



Tunnel connecting main building with stables, etc.



Switchboard Equipment for Casa Loma. The upper figure represents the Main Switchboard as it will appear when completed. The lower shows part of the distributing switchboard full extended; this board is 35 ft. long and will be set around three sides of the switchboard room.

of the switchboard room. This board will extend right to the ceiling of the room which contains it, and the ceiling itself will be finished in exactly the same quality of marble.

The switchboard will be mounted on an angle iron frame with tool-finished copper pedestals which rest on a black marble base, see figure. The base is of the sanitary base type, the projecting part being flush with the marble tiling of the floor. At the top of the switchboard there will be a marble moulding, but as noted above, the space between the ceiling and this moulding will be enclosed also with this same quality marble so as to give a uniform appearance to the whole room.

The door leading to the distribution room will be of open scroll bronze work backed by a polished wire glass panel. In the centre of the panel will be placed Sir Henry's coat-of-arms. The coat-of-arms will also appear on the upper part of the central portion of the switchboard immediately opposite the entrance door.

On this switchboard there will be mounted 152 automatic circuit switches for the control of 152 lighting circuits, and 160 plain circuit switches. The automatic switches are divided into groups as follows: 27 switches are operated by master board No. 1; 14 switches are operated by master board No. 2; 17 by master board No. 4; 19 by No. 5; 36 by No. 7; 6 by No. 9; 14 by No. 10; 19 by No. 11. Master boards Nos. 3, 6, 8, 12 and 13 are controlling lights already controlled by the other master boards.

One hundred of these automatic switches are controlled by the grand-master board as well as by the master boards and 70 of the plain switch circuits are controlled by the grand-master board.

The necessary master switches for each group will be installed on this board as well as the switches needed for the operation of the circuits controlled by the grand-selector switches. In addition to this there will be an automatic switch, 70 kw. capacity, for the control of lights in the stable, greenhouse, conservatories, lodge, Italian garden, and for electric fertilization. One of the features of the Italian garden will be a beautiful electric fountain. The board will also contain one automatic switch for the control of the standards of the lawn and one for the automatic control of the boulevard lights. Each of the standards and boulevard lights will have a capacity of 500 watts.

The illumination of this distribution room will be by indirect units from the ceiling. The rear of the board will be lighted by means of bulls eyes in the terminal boards. The illumination will be controlled from the threshold in such a manner that a person approaching the door completes the lighting circuit and on leaving breaks the circuit.

The walls behind the board will be finished in plain Italian marble. No wires of any kind will appear at the back of the board. The bus-bars for the lighting system will be painted cream color and the emergency bars black. Each circuit switch is provided with a name plate on both the front and back of the board. Access to the pole box behind the board is by means of hinged bronze panel boards securely held in position by means of vault handles and vault handle bars.

The circuits are protected by means of N. E. C. fuses for circuits of 30 amperes or less, and by copper fuses for over 30 amperes. The necessary master switches for each group will be installed on this board.

Dimmers

The dimmers are all remote controlled and motor operated, and the board for these will be located in a room adjoining that in which the distribution board is placed. Each dimmer will have 55 steps and is provided on the control board with 15 shade sections, so as to divide the light into 15 shades between full light and dark. Each gang and each individual dimmer has its own control board and actuating means between the control board and dimmer and terminal board, all of which forms one unit so that when replacing the dimmer it will be impossible to make a wrong connection between the dimmer and the wires operating the control board of the dimmer. The lights will be brought from full light to dark and vice versa in one half minute or two seconds to each of the 15 shade sections.

The different circuits are controlled by dimmers as follows: 27 of the circuits on group No. 1; 5 of the circuits on group No. 2; 17 on group No. 4; 19 on No. 6; 34 on No. 7; 14 on No. 10; 12 on No. 11; groups 3, 5, 8, 9, 12 and 13 are already controlled through other groups.

There are also 84 circuits controlling the lights in the picture gallery, one set to each picture, so as to be able to secure the particular shade of illumination best suited to each individual picture. All other dimmers are controlled in gangs only so there will be one uniform shade of light throughout the section illuminated by the dimmer controlled circuits.

All controlling wires from the dimmer switches are connected to an inter-connection box, from which connections are made with the control boards of the dimmers, and the inter-connection box is provided with bronze doors. Each of the connections on the inter-connection box is provided with a number for the identification of the wire connected thereto and a directory of the wires is installed on the doors of the inter-connection box.

The door leading to the dimming room will be a duplicate of that installed on the distributing room.

Another feature which is entirely novel, though at the same time most practical, is the method of illumination of the swimming bath. Lights will be installed in a channel cut in the floor of the tank and rendered water-tight by a glass covering. These lights will render a most perfect illumination of any object in the water and will give a very beautiful general effect.

It will be seen that most exceptional consideration has been given to the proper illumination of the art gallery. Each picture is controlled entirely independently of every other picture, both as to the shading and the control of the lamps which illuminate this particular picture.

Typical Lighting Equipments

Each of the 150 conduits carry three circuits of No. 12 copper, except in very rare cases, making a total of 450 circuits. Each of the circuits is calculated to feed twelve 50-watt lamps, so that the total installation, when complete, will be between 4000 and 5000 lamps. Of these lamps the room containing the largest number is the palm room, with 400, a good percentage of which are placed above a glass dome so as to produce a daylight effect. The arrangement of the lamps in the palm room is shown in the accompanying typical diagram representing one corner of the mansion including the palm room, dining room and one end of the art gallery or main hall.

As already stated the palm room is fed by 11 conduits or 33 circuits. The lamps are controlled by a push button master board equipped with 12 pairs of buttons. These are made up of one master button and 11 selectors, each selector having a small pilot lamp installed beside it. The following list indicates the detail of control in this room.

1—Raise and lower buttons for automatic dimmer.
2—Master button controlling all lights.
3—Lamps above glass of dome.
4—Four fixtures at corners of deck beam of dome.
5—Alternate lamps in square of dome soffit beam.
6—Alternate lamps in square of dome soffit beam.
7—Four ceiling fixtures in corner ceiling panels.
8—Eight ceiling fixtures in intermediate panels.
9—Two ceiling outlets on beam at east bay.
10—One light on each pilaster bracket.
11—Two remaining lights on each pilaster bracket.

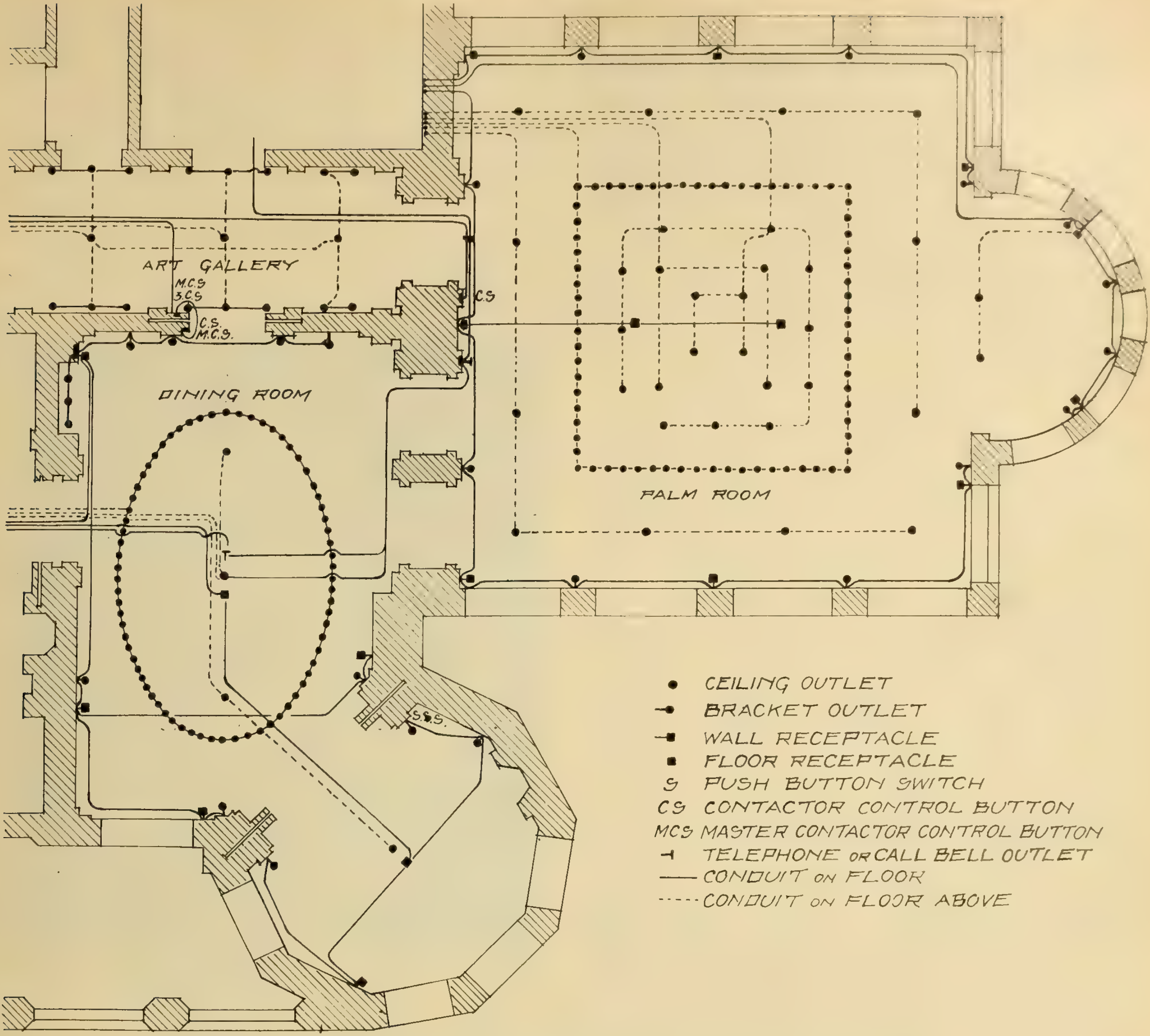


Diagram showing lighting outlets in palm room, dining room and end of main art gallery.

12—All base or floor receptacles.

In the drawing each outlet shown represents a probable installation of four or five lamp units.

The Dining Room

The dining room installation as shown, will require approximately 200 lamps controlled as follows:

1—Raise and lower dimmer buttons for all lights.
2—Master switch for all lights.
3—One-half of centre fixtures.
4—Second half of centre fixture.
5—Two outer ceiling fixtures.
6—One-half of wall brackets.
7—Second half of wall brackets.
8—Sideboard and china cabinet lights.
9—Alternate lights in dome soffit.
10—Balance of lights in dome soffit.
11—Floor plugs and base receptacles.
12—All lights in dining room alcove.

The Telephone System

One of the largest residence telephone systems in America will be installed, consisting of 32 sets connected by four trunk lines with a central city exchange. The system will provide interior communication between all the 32 instruments as well as give an exchange service over the trunk lines from any instrument in the system. There will be no local switchboard, the arrangements being such that any one of the 32 telephones can be called by the city central and vice versa. The sets will be recessed and equipped with a flush plate block of keys. The finish will be specially designed and harmonized with the hardware throughout the rest of the house. The equipment is being supplied by the Bell Telephone Company of Canada, and will be in every respect, one of the most modern of its kind on the continent.

The Heating Plant

The heating plant is located underground in the south end of the stables. The boiler room contains three high pressure boilers of 125 boiler h.p., and each boiler is equipped with automatic stokers. From the central plant the main residence, as well as the stables, conservatories and two cottages are heated by the Webster Vacuum Heating System. An auxiliary hot water heater is provided for the purpose of heating the conservatories during the summer months. The coal bin has a capacity of 250 tons and is located underground so that the coal may be dumped in from the top. There are two boiler feed pumps with automatic pump governor going into same. The American Blower Company, forced draught system is used for the boilers. There will also be located in the pump room two air compressors for the Johnson Thermostatic Control System by which the temperature of the radiators will be automatically controlled. A 6-inch extra heavy main carries the steam from the boilers through a tunnel 500 ft. long to the main residence. See Figure.

There are three curves of 100 ft. radius in this tunnel. The steam main and the exhaust pipes are anchored in the centre of the tunnel and the expansion is taken care of in each direction by expansion joints. The feeders for the cottages and conservatories are taken from the main in this tunnel.

There are two vacuum pumps, one of which is running constantly in order to keep up the vacuum in the exhaust pipe and return all condensation to the boilers. A 4-inch return main is concealed underneath the floor of the tunnel. The exhaust steam from the pumps is passed through an oil reflector and returned to the exhaust system. The condensation in the main steam line is collected by means of pumps and also pumped into the exhaust system. This work is being installed by the W. G. Cornell Company, of New York, Mr. Henry De Beauher being in charge of the heating work throughout.

In the north end of the residence is the distributing point where the steam is reduced from a pressure of 60 lbs. to 2 lbs. by means of a reducing valve, which is protected by a high pressure bi-pass in case of accident to the reducing valve. From this distributing point the 10-inch low pressure main is run which branches into an 8-inch and a 5-inch main. A 3-inch high pressure main runs from here to the domestic quarters for heating the laundry, swimming pool and for other domestic purposes. It is also desired to cook by this high pressure steam.

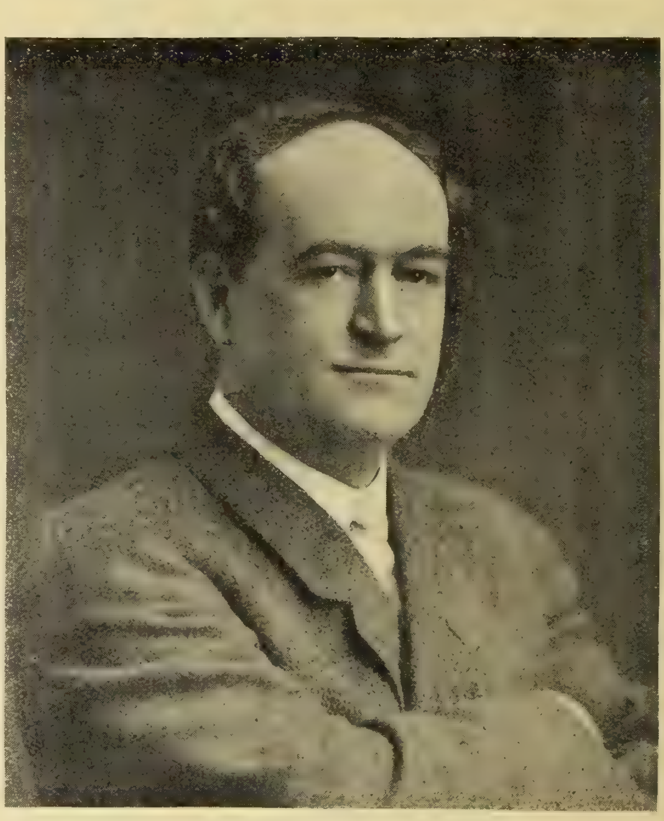
The 8-inch low pressure main runs around the south side of the building, distributing to the risers. The basement is heated by means of wall radiators hung from the ceiling. The main floor is heated by both direct and indirect heating. In the indirect heating cold air is brought into the radiators in the basement and passed up into the rooms above, automatically controlled by dampers. The domestic servants' room is heated by high pressure steam in the winter time supplemented by a low pressure auxiliary boiler of 5,000 sq. ft. heating surface for summer use. The pool heater is located in the room underneath the servants' quarters and is used for heating the swimming pool. It is supplied by high pressure steam. A circulating pump of 6 h.p. draws the water from the bottom of the swimming pool, circulates it through the heater and back into the tank. As soon as the water in the tank becomes of the proper temperature the functions of the pump automatically cease. All heaters are automatically controlled by thermostat. All pipes and fittings in the domestic servants' room, pool, heating room and laundry are made of brass. 10,000 ft. of this pipe is installed, ranging in size from ¼ to 4 inches and covered with hard felt sectional covering. The laundry is located underneath the kitchen and is fully equipped and also supplied by high pressure steam.

An ammonia refrigerating system which supplies the refrigerators in various parts of the building is located underneath the kitchen. This refrigerating room is finished in white tile.

The swimming pool, 24 ft. wide by 60 ft. long, is 9 ft. deep at one end and 3 ft. deep at the other. The cold water is taken from the lowest end and circulated through the heater and back through percolators located at the side walls around the tank. Located every 10 ft. around the swimming pool are scum drains.

The pump room is heated by direct indirect heating. The centre pump in the pump room is heated by direct heating to evaporate all moisture.

Roof coils are placed underneath the eaves inside the building to melt all snow and ice which would collect there. All leaders to the roof coils are connected with the steam connection in case of freezing so that the ice can be melted and the leaders be freed. The towers are also heated up to the fifth floor. The risers and branches to radiators are covered with 85 per cent. magnesia covering. All risers and branches to radiators are extra heavy pipe with Crane fittings suitable for a working pressure of 250 lbs.



Mr. William B. Boyd, M.I.E.E.

Throughout the building there is a system of vacuum cleaning with outlets in all rooms and corridors installed. The motor operating the vacuum cleaner will start automatically on opening any one of these outlets.

All water entering into the building is taken from two water mains on the street and is filtered, even to the water used in the swimming pool. The plumbing system throughout is known as the Durham system and is also installed by the W. G. Cornell Company, in charge of W. O. Wolly.

This unparalleled installation has been made possible through the unremitting activity and attention of Mr. W. B. Boyd, who was given "carte blanche" by Sir Henry, to see that the work was carried through with as little delay as possible, that such labor was employed as in Mr. Boyd's opinion should be necessary, and that the installation should be so complete and so skilfully installed that there could be no possibility of a mistake or hitch in the whole matter.

The switching equipments, including the main boards, the dimmers, and the smaller control boards throughout the installation were designed, manufactured and installed by the H. Krantz Manufacturing Company of Brooklyn, N.Y., for whom Mr. C. H. L. Keeler, Toronto, is Canadian agent.

Testing of Telephone and Telegraph Lines*

A Series of Short Articles Based on the Author's Practical Knowledge and Experience— Applicable to Plant of Any Size or to any manufacturer's Equipment

By Mr. T.H. Nicholson

Arrangement of Testboard

As the design of small testboards will usually depend to a large extent on the apparatus available no attempt will be made here to describe suitable arrangements for such boards, but in the case of larger installations the efficiency of the whole is largely affected by the ease of operation of the testboard so it is profitable to elaborate somewhat on the planning of this part of the equipment. The testboard here described is of the single position type and is given as a collection of ideas that have severally worked out admirably and are arranged to the best advantage of each and to one another. These ideas may be used in the design of a testboard or may be specified in orders covering such equipment.

The testboard may consist of a suitable framework with one or more jack panels and a keyboard for the necessary testing keys and arranged to mount both the voltmeter and Wheatstone bridge flush on it. The auxiliary apparatus and relays for trunks, etc., may be mounted in the rear. The section should be of the low type, that is, with keyboard low enough to permit the use of ordinary desk chairs in that under these conditions less effort is necessary to manipulate the testing apparatus. The voltmeter should be mounted horizontally on the keyboard for the reason that this has been found to be less tiresome on a testman than when it is located in a panel at an appreciable distance from his eyes. The keys should be of the vertical spring type, and should be of the two or three lever variety if possible so that compound tests can readily be made without any extended effort.

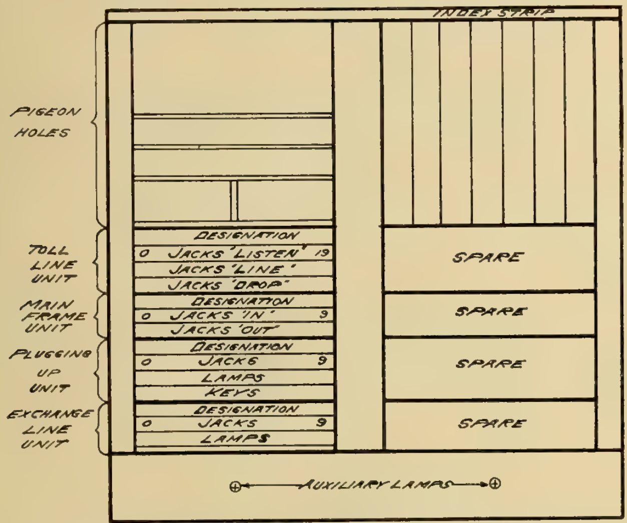


Fig. 1. Typical front equipment of a test board.

Fig. 1 shows a plan of the face equipment for a single position, two panel section. As will be noted this provides equipment for terminating the test circuits of a small local and toll exchange. There is but one unit of each group of circuits shown for illustration but the actual layout may be as necessity demands. The "Toll Line Unit" is arranged to permit of all toll lines being carried through the testboard, with a jack for listening or superimposing bridging apparatus, a jack that is connected directly to the line and cuts off the office when a plug is inserted, and a jack that is connected to the switchboard wiring and cuts off the line when operated. The "Main Frame Unit" is to terminate suitable cords and plugs to be located on main frame for testing directly on cable conductors. This unit like the toll line unit, is provided with jacks that permit of testing "in" or "out" with rest of circuit cut off. A listening jack is not usually required on such circuits but may be provided if desired. The "Plugging Up Unit" is for circuits terminating on the switchboard on cords and plugs, which are designed to be used on a line in trouble and may be arranged with signal circuits to indicate varying conditions of the line plugged up when desired. Some examples of practical circuits for the above units will be later given under a discussion of auxiliary testing circuits.

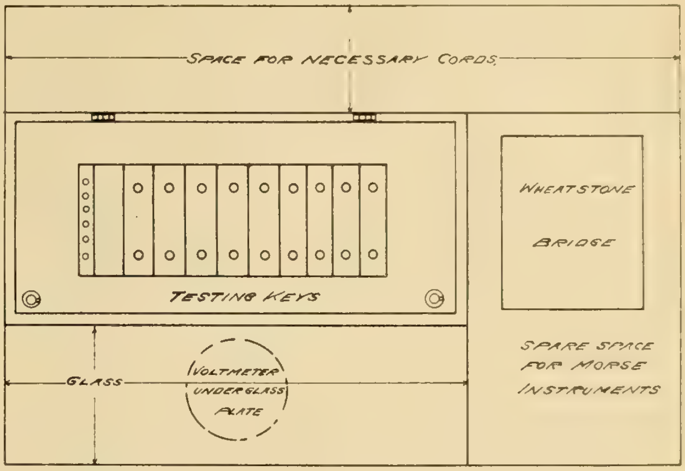

SPACE FOR NECESSARY CORDS
TESTING KEYS
WHEATSTONE BRIDGE
GLASS
VOLTMETER UNDER GLASS PLATE
SPARE SPACE FOR MORSE INSTRUMENTS

Fig. 2. Typical keyboard plan of a test board.

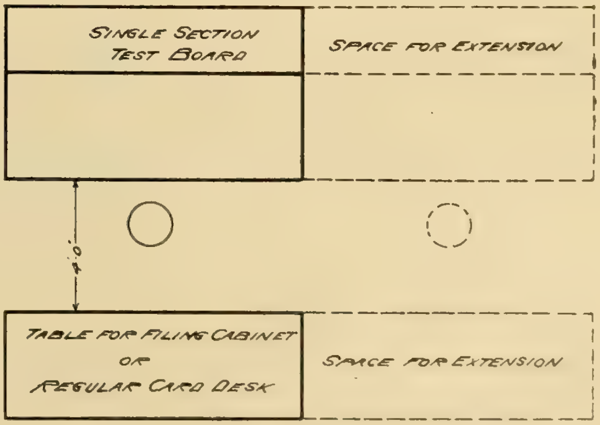

SINGLE SECTION TEST BOARD
SPACE FOR EXTENSION
TABLE FOR FILING CABINET OR REGULAR CARD DESK
SPACE FOR EXTENSION

Fig. 3. Typical floor plan of a test board.

Fig. 2 shows a typical keyboard arrangement suitable for testing the class of circuits shown on the units of Fig. 1. On this plan a generous space is provided for cords and keys so that when improved methods are available, or additional facilities are required, they can be provided for without crowding the apparatus to a degree that hinders operating. The general arrangement of this keyboard is one that provides for efficient handling of testing circuits and apparatus without the confusion that is often experienced with keyboards that are less uniformly laid out.

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Fig. 3 shows a typical floor layout that considers the relation of testboard to filing cabinet. The location of a testboard however will usually be governed entirely by local conditions, so no attempt will be made to suggest possible locations, except to emphasize the importance of good light and close proximity to terminal apparatus.

"Gerrard" Office of the Bell Telephone Company, Logan Avenue, Toronto, Ont.

The Bell Telephone Company of Canada have opened an office building on Logan avenue near the corner of Gerrard street east, in Toronto, and have installed a common battery central office telephone equipment, which has been in service since April of this year.

The growth of the district in which the office is situated is such that its capacity will be required to take care of the growth of the north eastern section, which has been so rapid as to justify and necessitate the opening of this new office.

The building is 110 feet long by 40 feet wide, two storeys and with a high basement, designed to carry another storey in the future. The construction throughout is of the best fire resisting type. The front of the building is finished with red pressed brick and red sandstone trimmings. The design is of a simple dignified character with a large window area, giving the building a maximum of light and air.

The main entrance is on the side towards Gerrard street, the vestibule of which leads into a commodious entrance hall, from which the operators' quarters are entered, occupying the front half of the ground floor fronting on Logan avenue. The operators' quarters contain a large locker room (in which are placed the operators' clothes, lockers and drying closet), lunch room, kitchen, rest and retiring rooms, and sick room. In the basement beneath the locker room, reached by a private staircase, are the operators' toilet and bath rooms.

The rear half of the ground floor is entirely devoted to the housing of the power and terminal apparatus associated with common battery switchboards of the type being installed.

The entire top floor is used as an operating room and contains the subscribers' and incoming trunk switchboards. It is particularly well lighted and well ventilated.

The whole of the central portion of the floor of the operating room, that is between the switchboards, is raised 13½ inches higher than that portion of the floor on which the switchboards stand. This construction permits of the operators sitting on chairs of normal height and, at the same time, more readily permits of their making any connection to the most distant parts of the switchboard which they are obliged to reach. At the same time, access to all parts of the back of the switchboards is exactly the same as in buildings of earlier construction where the entire floor of the operating room is on one level.

A particularly good fire escape is provided outside the building, reached by doors swinging outward from the operating room and from the operators' quarters to the street beneath.

In the basement are situated furnace and coal rooms, men's lavatories, battery room and cable terminal entrance.

The switchboard equipment is of the latest standard common battery relay type and was supplied by the Northern Electric & Manufacturing Company, Montreal.

The lines enter the building underground in lead covered, paper insulated cables and are connected to the main frame by silk and cotton covered insulated cables.

The main, intermediate and relay frames, the coil racks for the lines and in-trunk switchboards with their fuse panels, the power plant and two-position inspectors' desk are located in the terminal room at the east end of the ground floor.

The power plant consists of the main battery of 11-G chloride cells and a smaller set of 11-E-11 cells, the latter battery being used to reinforce the main battery for long distance work.

Two Western Electric Company's motor generator sets are provided for charging the larger battery, one being held in reserve in case of a break down. Each consists of a Western Electric Company's generator of 18,000 watts capacity at 30 volts, directly connected to a 30 h.p., 550 volt, 3-phase, 25 cycle motor. The generators are of a standard telephone design specially built for charging telephone batteries, having a large number of segments in their commutators and with specially shaped pole pieces, the idea being to eliminate noise from the associated telephone service when the battery is being charged. The smaller battery is charged by a smaller generator which has an output of 600 watts.

Two machines are provided for furnishing alternating current for ringing subscribers' bells and with special interrupters arranged to give automatic intermittent ringing of subscribers' bells on calls originating from the other offices. These interrupters also give an interrupted direct current to work the many signalling circuits required for an equipment of this type. The necessary switches, circuit breakers, measuring instruments, etc., are mounted on a black slate switchboard.

From this terminal room the lines are run to the switchboards on the floor above in switchboard cables supported on structural steel runways.

Two separate switchboards are provided, one to care for the subscribers' lines directly connected to this office and the other one, the in-trunk switchboard, to complete connections that originate from the other offices. Both switchboards have a capacity of 10,400 lines and are equipped for 4,000 lines. They are equipped with the latest types of circuits, those of the in-trunk switchboard include the keyless incoming trunk circuits.

All the structural steel telephone apparatus in the terminal room are painted with aluminum paint (not the usual grey iron filler paint) and gives the room a bright and cheerful appearance.

New Wireless Station for Montreal

The Federal Government propose to erect a wireless station on Mount Royal, Montreal, and have asked the city to reserve land 800 feet long by 200 feet wide for this purpose. The station will consist of two wooden masts, 180 feet high and 450 feet apart, and one operating house 40 feet long by 20 feet wide. The erection of the station is due to the increasing number of vessels plying to the port of Montreal. The station will be capable of communication with the Quebec station to the east and the Kingston, Ont., station to the west, thus linking up the Government wireless stations on the Great Lakes with that on the east coast, and completing a chain of stations which will extend from Port Arthur at the head of the lakes to Cape Race and Belle Isle on the Atlantic. There is at present a station in Montreal, but it has a very limited range which cannot be increased owing to the position of the site. The National Battlefield's Commission have given the Government leave to erect a station on the battlefield at Quebec.

Electric Railways

Toronto's Municipal Railways

In addition to the municipal line recently placed in operation on Gerrard street east, by the municipality of the city of Toronto, there is at present under construction two sections of railway which will add about seven miles to their system. On St. Clair avenue the line is practically complete for operation from Yonge street west to the Northern Division of the G. T. R. line, a distance of about 3.2 miles. It is expected that operation of this line will commence inside of two months. On Danforth avenue the work is not so far advanced but it is expected that 3½ miles of line from Broadview to the eastern city limits will be in operation some time this fall.

The work on St. Clair avenue presents a number of interesting features, one of the most important of which was the widening of the street from the original 66 feet to 100 feet. Though this represented a big expense there is little doubt but that the added attractiveness of the avenue with the much greater space allowed for traffic will more than offset the additional capital expenditure.

The St. Clair avenue installation is shown in section in Fig. 1 herewith. It will be noted that the trolleys are suspended from a single pole placed in the centre of the roadway. Each trolley wire hangs 9 feet from the centre line and at a distance 18 feet 6 inches from road level. These poles are set 6 feet in the ground in concrete.

The gauge used on all the municipal lines is 4 ft. 10⅞ in. to correspond with the Toronto railway system. On the St. Clair line, as seen in Fig. 1, the devil strip is 7 feet wide. No concrete is used under the rails, the filling being gravel to the top of the ties and from there to the top of the rail 2-in. crushed stone. A 4-in. tile drain is placed, as shown, at the centre of the roadway with 3-in. tile at the sides. On each side of the tracks as far out as the inner curb of the roadway, for a distance of 4 ft. 9 in., the space will be sodded.

The roadway on each side of the tracks will be 18 ft. wide with a 4-in. crown. The composition will consist of a 6-in. concrete base, a 1-in. binder and a 2-in. asphalt surface. The concrete walk on either side is 5 ft. 6 in. in width, the sidewalk being placed 2 ft. from the curb and 7 ft. 6 in. from the outer street limits.

At street corners where loading and unloading takes place, the 4 ft. 9 in. grass boulevard will be replaced by cement running back from the corner some 55 or 60 feet.

Lorain section No. 335, 7-in. T-rail, 80 lb. to the yard has been installed on untreated cedar ties. The trolley wire is a No. 2/0 hard drawn round copper. The distributing cable is 500,000 c.m. W.P.T.B. Current will be supplied from the sub-station of the Toronto hydro-electric system on Macpherson avenue, where sufficient converter equipment will be installed to supply the necessary current at 550 volts d.c.

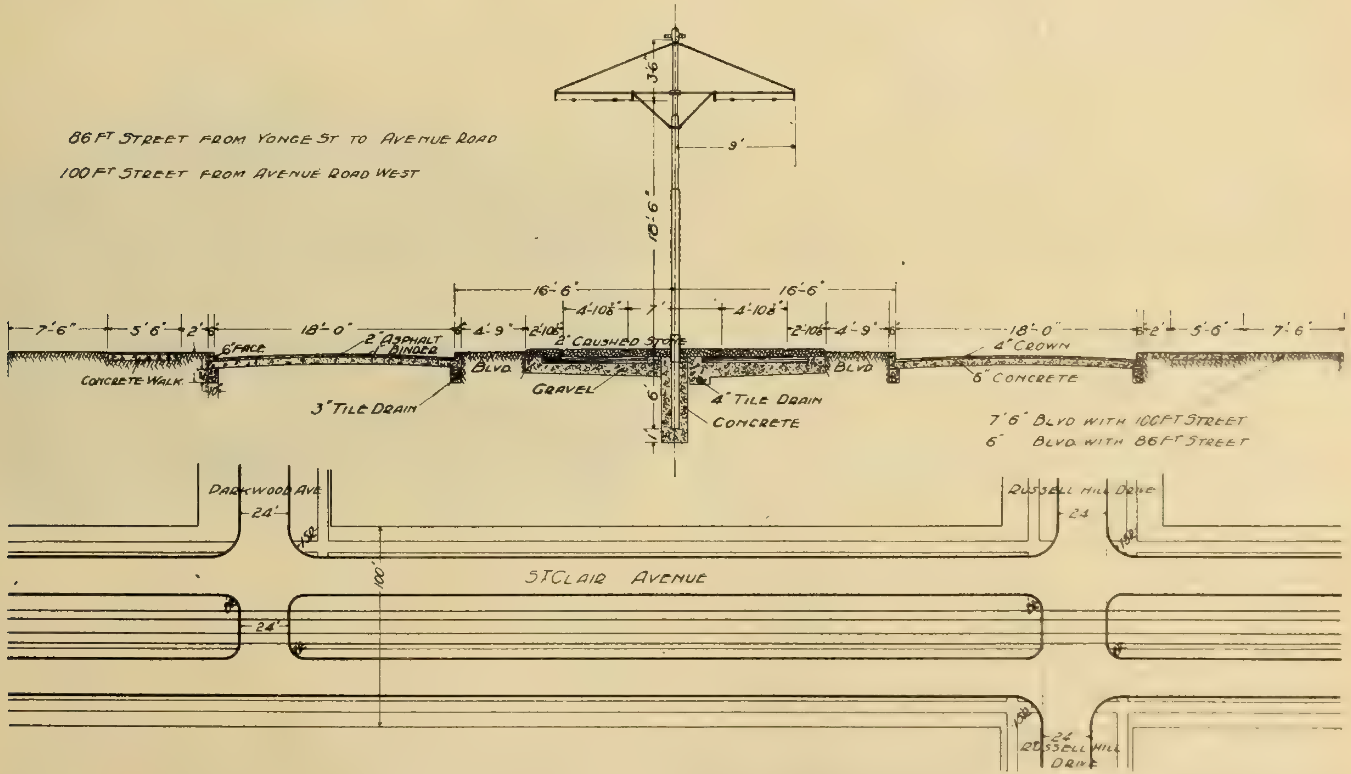

Fig. 1.—City of Toronto municipal street railway lines—Section of St. Clair avenue roadway.

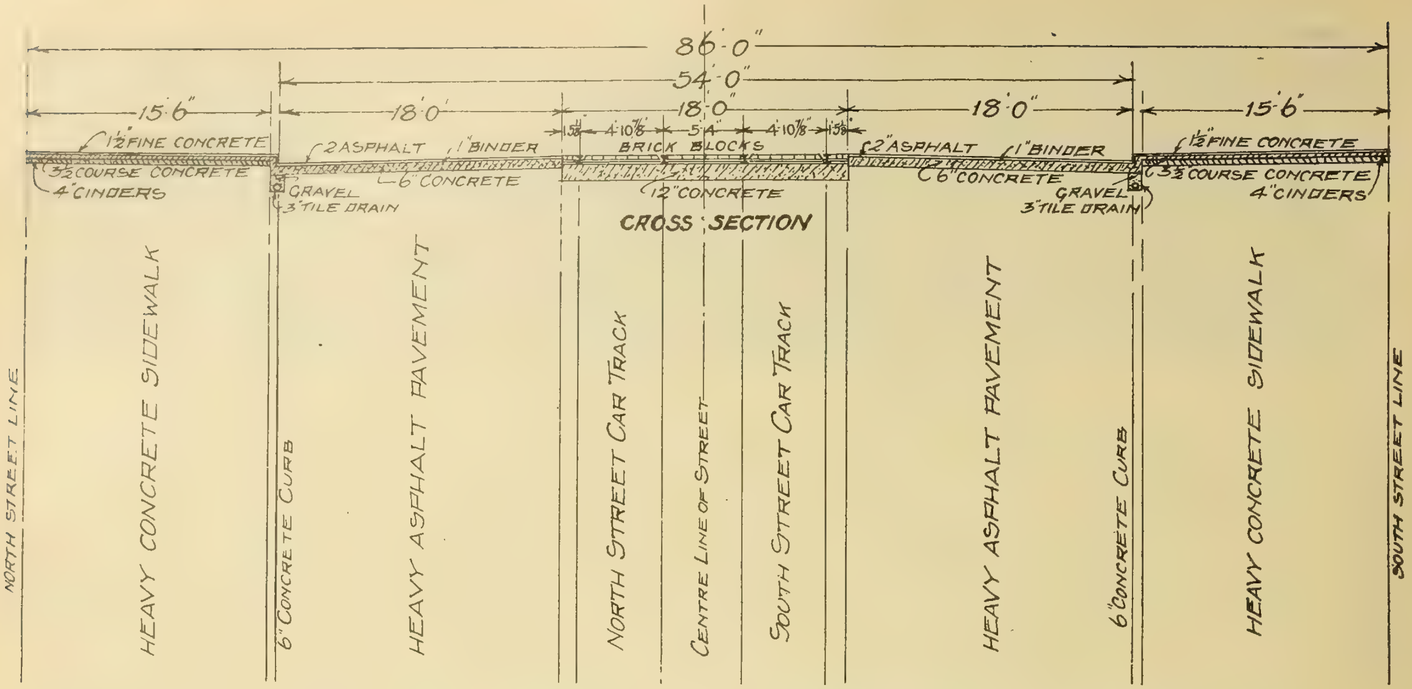

Fig. 2.—City of Toronto municipal street railway lines—Section of Danforth avenue roadway.

Danforth Avenue

The original 66 ft. road is being widened to 86, and a section of the installation is shown in Fig. 2. The 86 ft. is apportioned as follows: 18 feet for the tracks, 18 feet for each of the side roadways and 16 feet for the sidewalk and corresponding boulevard. The devil strip is 5 ft. 4 in. Lorain section No. 392, 7-in. girder rail is being installed, 90 lbs. to the yard, with tie plates and continuous rail joints. Cedar ties will be used on a concrete bed covered with wood paving. Power will be temporarily supplied from the sub-station of the Toronto hydro-electric system on Gerrard street east.

2/0 round copper trolley wire is used. The trolley wires are suspended from poles placed at the sides of the roadway, wooden poles already installed and belonging to the Toronto hydro-electric system being used on one side and iron poles on the other. These iron poles will carry city lamps for the illumination of the street. By this reciprocal arrangement the number of poles that must be installed on this street has been reduced by one-half.

Ten cars for each of these lines has been purchased from the Niles Car & Coach Company. The electrical equipment of each consists of four G.E.-80 motors and K-28 controllers with Westinghouse air-brakes, Baldwin trucks and Canada Iron Corporation chilled wheels. Each car is equipped for double end control. The cars will be centre aisle type, p.a.y.e., 44 ft. over buffers, and will be similar to those already in use on the Gerrard street line. When equipped for operation each car will weigh approximately 24½ tons. In all probability the parts will be brought to Toronto and the cars assembled here.

The work of installation of the municipal car system is in charge of the works department under Mr. R. C. Harris, commissioner. More closely connected with the work is Mr. C. W. Power, assistant engineer of railways and bridges. Mr. D. W. Harvey is in immediate charge of the construction work.

Montreal Tramways Roadbed Improvements

Some 1,200 men are being employed by the Montreal Tramways Company in re-laying tracks in different parts of the city, part of an extensive programme which will be carried out during the next few months. The old rails of 96-pounds weight are being replaced with rails of 116 pounds, the guard rails being increased to 132 pounds; these will be standard for the future. In certain sections special cedar ties are being laid down, the length being increased from seven to eight feet, while they are put two feet apart instead of 2 ft. 6 in. The roadbed has been greatly strengthened, with a view to resisting the frost. Eight inches of crushed stones are followed by two inches of stone dust as a bed for the ties; then comes six inches of concrete, the blocks being laid on this mass and grouted with cement, making a bed of 21 inches in depth.

New Cars for Moose Jaw

The Moose Jaw Electric Railway Company have recently placed in operation a number of new cars manufactured by the Ottawa Car Company. These cars have a seating capacity of 32. The length of the car body is 21 feet; the front vestibule 4 feet; rear vestibule 5 feet; length over bumpers 31 feet; width of body outside 8 ft. 1¾ in.; inside 7 ft. 3½ in.; length of seat 34 in.; aisle width 20 ft.; cross seats covered with rattan. There are six cross seats on one side and five on the other with two longitudinal seats. The interior finish is red cherry with the ceiling of bird's-eye maple veneer, all in natural finish. The cars are equipped with Peter Smith heaters.

New car for Moose Jaw electric railway.

Permanent Track Construction

By Mr. C. B. Vorce,* Mem. A. S. C. E.

The B. C. Electric Railway Company, Limited, is a public service corporation operating the electric railway lines in Vancouver and adjacent municipalities on the mainland, together with the electric railway lines in Victoria, situated on Vancouver Island. The total length of railway operated is 303.54 miles, of which 148.77 miles are city lines and 154.77 miles are interurban lines. Of the city lines, 43.43 miles are double track and 61.91 miles are single track. 77.13 miles are of permanent construction on paved streets and 71.64 miles are standard steam railway construction on unpaved streets. The country in and around Vancouver is a rolling country and the maximum grade is 8.75 per cent. while in and around Victoria is flat giving no grade of more than 3 per cent. The population served by the railway on the mainland is about 200,000, while the railway in Victoria serves about 75,000 people. During 1912, 50,000,000 passengers were carried on the mainland and 12,000,000 in Victoria.

T rails are used exclusively on paved streets, 7 inch rails weighing 91 lbs., 87 lbs. and 70 lbs., depending on the amount of traffic. On unpaved streets and on the interurban lines where the standard steam road construction is used, the rails are either 70 lbs. or 60 lbs. A. S. C. E. section.

Previous to the writer's connection with the company the concrete girder type of construction was used on all permanent track work on paved streets, but owing to the breaking of the girder, due to the poor character of the foundation, the writer recommended and secured the adoption of the slab type of construction, Fig. 1, which gives a solid foundation on which to lay the track. The sand cushion was introduced between the concrete foundation and the tie to give the track as much resilience as possible, as the writer believes that the rigid type of construction resulting from the rail laid on steel ties embedded in concrete materially increases the cost of car maintenance.

Under our various franchises the company is compelled to replace the open or steam railway type of construction with a permanent form of construction whenever the city or the municipalities permanently pave the streets. The cost of this paving from curb to curb, together with concrete foundation is borne by city or municipality. Before the writer became connected with this railway company the permanent track work was let by contract to the contractor for the city paving. This method gave such poor results that the writer organized a construction department to enable the company to do the work themselves. The plant used in doing this work is as follows:—

One Model 40 Marion steam shovel.
One Model 20 Marion steam shovel.
One A1 Thew automatic steam shovel.
One A1 Thew automatic electric shovel.
One steam derrick with 60-foot boom.
One Brown hoist derrick car.

Two Koehring concrete mixers with 27 ft. delivery boom operated by gasoline.

Two Koehring concrete mixers with 30 ft. delivery boom operated by gasoline.

One Koehring concrete mixer with 30 ft. boom operated by steam.

One 3-ton Packard motor truck.

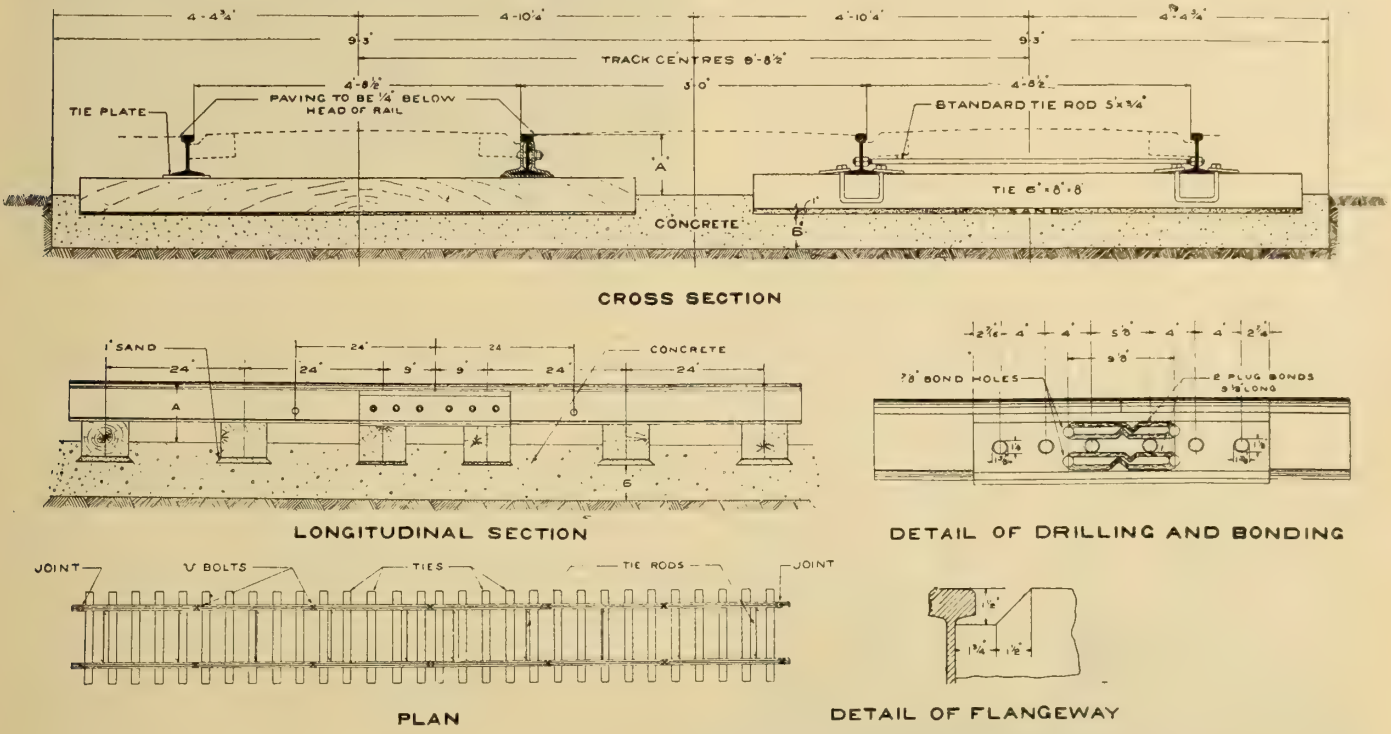

Fig. 1.—B. C. E. R. track construction.

Five Duntley track drills.
Two Duntley track grinders.
Two rail planers.
Six centre dump wood ballast cars, 20 yds.
Four side dump wood ballast cars, 20 yds.
Five Koppel steel side dump cars, 15 yds.

Shunters are assigned to the construction department by the transportation department as required for construction work.

The method of construction is as follows:—Whenever the company is notified that the city or municipalities are ready to commence paving operations the railway company, whenever the width of the street will permit, build a temporary track on the side of the street with sufficient passing sidings to take care of the traffic. This leaves the centre of the street free and allows the building of the permanent double track without interruption. It might be added here that all paved streets are double tracked.

Grading operations are then started, the material being hauled by teams to a dumping place fixed by the city. In previous years all the material has been excavated by hand but during the coming season a steam shovel specially designed for shallow cutting in the track allowance will be used. It is hoped that this will materially reduce the cost of excavation, as common labor is paid from 25c to 37½c per hour. When the rough grading has been completed forms are set on each side of the track allowance, 18 ft. 6 in. wide, the top of the forms being the top of the concrete slab, and a gang of fine graders trim up the excavation to a grade 6 in. below the top of the forms. The concrete slab is then started. The gravel, sand and cement are delivered along side the track allowance, thus minimizing the distance travelled by the wheelbarrows, and the aggregate is delivered in place by a bucket travelling on the mixer booms. In this way labor, which is the most expensive item we have here, is reduced to a minimum.

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* Construction Engineeer B. C., Electric Railway Company, Vancouver, B. C.

After the slab has set for one day, the rails are laid on ties placed 2 feet centre to centre except at the joints where the spacing of the ties is governed by the length of the joint. The ties are then shimmed up to grade by placing small pieces of factory wood clippings at each end. A concrete mixer, Fig. 2, running on flanged wheels is then placed upon the track and the second operation, which brings the concrete up to the under side of the city's pavement foundation is commenced.

The remainder of the work in the track allowance, viz., paving together with the foundation for same, is paid for by the city or municipality.

So much delay and confusion has arisen on account of the railway company being unable to commence its work until the paving contractor had excavated to the city's subgrade in the track allowance, that the writer entered into an arrangement with the city authorities so that whenever possible the railway company enters into a contract with the city to do the grading and concreting in the track allowance at the same price as the city pays the paving contractor—this arrangement has so far worked very satisfactorily.

During the past few years the railway company has done a considerable amount of track reconstruction. In some cases we have been able to divert the traffic to other routes, which has enabled us to reconstruct both tracks at the same time. In other places, however, we have built one temporary track and rebuilt one of the permanent tracks at a time, as it was necessary to have a double track to handle the traffic.

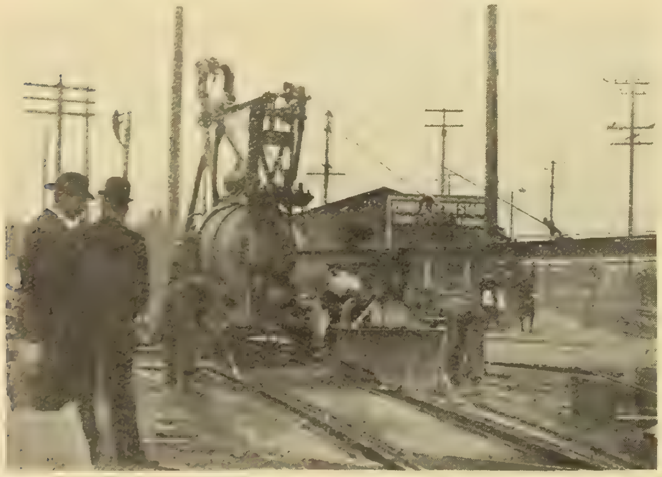


Fig. 2.—Concrete mixer on flanged wheels.

In this reconstruction work the principal difficulty encountered has been the removal of the concrete. Labor is so high that the manual method in use before the writer became connected with the company could not be used economically. Some mechanical method had to be adopted and the writer designed the "so-called" concrete breaker shown in Fig. 3. The dipper was taken off our electric shovel and pile driver leads were hung from the boom. In these leads ran a 2,600 lb. hammer with a wedge shaped base. The concrete was broken by dropping the hammer. The smaller pieces were loaded into skips which were dumped into wagons, and the larger pieces were handled by a steam derrick and loaded on to flat cars. This method was about one-half as costly as the old hand method.

This year we purchased an A1 Thew automatic shovel specially designed to dig in the track allowance, and in a piece of track reconstruction just finished we have not used the concrete breaker but have taken out the concrete with the shovel, Fig. 4. This has further reduced the cost of removing the concrete so that the cost per yard for removal is only about 65 per cent. of what it was last year.

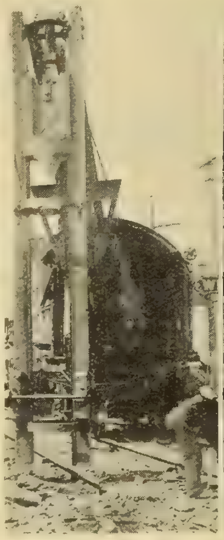


Fig. 3.—Concrete breaker.

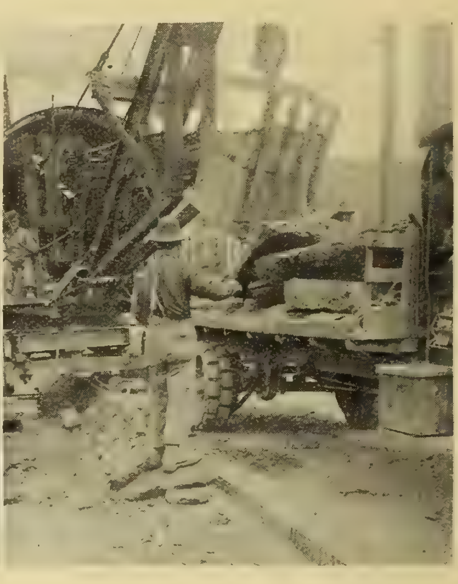


Fig. 4.—Shovel loading concrete on motor truck.

At intersections solid manganese tongues, switches, mates and frogs are used in the special work and when the traffic is particularly heavy the curved rails are also of solid manganese.

The special work is installed without interrupting the traffic, the greater part of the work being done at night after traffic has stopped. The track allowance is first excavated to a point from 20 in. to 22 in. below the top of rail and new ties are put in on blocks so that when the special work is laid on them it will be to the established grade. As many pieces of the special work as it is possible to handle are bolted together and put in place with the derrick car. The intersection is then concreted, the concrete being brought up to within about one and one-half inches of the base of the rail in one operation. Short blocks, 20 in. long, 6 in. wide, and 4 in. deep, are then embedded in the concrete between each of the ties and the concrete is then allowed to set for ten days. Wedges are then inserted on top of these blocks and the special work brought to a firm bearing. The spikes are then drawn from the ties which are pounded down, thus taking up any settlement which may have occurred. Steel shims are inserted between the tie and base of rail and the concrete brought up to the base of rail. This method has proved very satisfactory and we have had no trouble with the special work, some of which has at least 3,000 cars per day passing over it.

Although common labor is paid from 25c to 37½c per hour and our cement costs us $2.60 per bbl. of 350 lbs. our construction costs (1), compared with one of the largest cities in Eastern Canada (2), and one of the largest cities in the United States (3), are as follows:—

	1	2	3
Removing pavement	37%	58%	100%
Earth excavation	67%	68%	100%
Concrete excavation	37%	....	100%
Laying concrete	60%	100%	.....
Laying track	73%	....	100%
Concrete per yd.	68%	....	100%

The writer has been ably assisted in his work by H. J. Tippet, engineer maintenance of way, and by A. J. Kennedy, roadmaster.

Medicine Hat to Have Privately Owned Railway

The street railway by-law submitted to the electors of Medicine Hat, Alberta, on May 22, authorizing an agreement with the Montreal Engineering Company by which the latter should construct and operate an electric railway service in Medicine Hat, was carried by a large majority. It is understood that operations will be commenced immediately, and that a steam power plant will be installed using gas, supplied by the city at 5c per thousand cubic feet, under the boilers, or the city will furnish company electricity.

The main items of the franchise are contained in the following summary:—

Synopsis of Medicine Hat Franchise Agreement

The franchise is an exclusive one for twenty years within the present or extended boundaries of the city.

The city council can call for a line on any route when a population, excluding children under five years, is 400 per half-mile, the width of area to be included being 1/8 mile on each side of the street.

The council can call for extensions to any residential section if the line to this point passes through an area which averages 400 to the half-mile, as above.

Failure to extend the line after due notice renders the company liable to a fine of $100 per day.

The company pay taxes on land until the population of Medicine Hat reaches 40,000; from this number to 100,000 5 per cent. of gross earnings in lieu of taxes; above 100,000 10 per cent. of gross.

The city has complete control over the streets on which the railway is built and over the specifications according to which the line is constructed. Feed wires on streets where cars are not operating must be underground.

The company must buy gas from the city at 5c per thousand feet or electricity at 1c per kw.h.

Passenger cars operate between 6 a.m. and 12 mid-night. Tickets are 5c cash, 6 for 25c, 25 for $1.00; workmen's tickets, 8 for 25c; school children's, 10 for 25c. If the company decides to run night cars they may charge a 10c cash fare. Freight may also be moved between 12 midnight and 6 a.m., and at other times as arranged with Corporation.

The city may use company's poles to string municipal wires.

Interurban railways are allowed to enter the city and run over the company's lines, but it is necessary that the consent of the city be first obtained.

No local business can be done by an interurban railway.

The company maintains that portion of the street between the rails and 18 inches on each side. The rails must be 80 lb. weight.

Provision is made limiting the amount of street that can be broken up at any one time by the company to 2,000 feet.

The city has full control of the schedule and stopping places of cars.

Provision is made for the free transportation of municipal officers, such as policemen, firemen, meter-readers, etc., when in uniform.

The company flushes the streets along the lines of its railway, the city paying for the same at actual cost.

In case of dispute provision is made in the agreement for the appointment of a board of arbitrators, but there is to be no appeal outside of the province of Alberta.

If the city decides to take over the property of the company at the end of twenty years, the value of the plant fixed by arbitration plus 15 per cent. is to be paid for it. The franchise is not to be considered in this valuation.

The first section of the road is to consist of nine miles, this to be interpreted as meaning nine miles of street.

Mr. J. B. D'Aeth, formerly with the Stone & Webster corporation in the construction of the Saskatoon railway system, will be the resident engineer in Moose Jaw, and will be asisted by Mr. L. G. Mills, of the Montreal Engineering Company's staff. Mr. D'Aeth will be responsible to general manager R. O. Sweezy, who will be located at Montreal.

Montreal Tramway Congestion

Mr. G. Janin, chief engineer of the Montreal City Council, has submitted a report on the tramway congestion to the Board of Control. He has had under consideration various schemes submitted by Mr. D. McDonnell, Mr. J. P. Fox, and others, and states that immediate steps should be taken to procure increased facilities in almost every part of the city. An effort should be rather to eliminate some of the overlapping and inter-crossing of the cars belonging to the various routes in the cramped space of the downtown district. This can be done by stopping some of the routes just outside of the congested area, and whenever possible causing the cars to perform their turning operations by means of tracks which do not interfere with the actual movement of loaded cars. The recommendations include the elimination of all unnecessary stops, placing switchmen at every important junction point, teaching passengers to have their fare ready, the installation of larger and clearer signs on cars, the relief of congestion in the rear part of cars, the prohibition of the hauling of freight in day time, better supervision of traffic at junction points, doing away with delays at the central office, the prevention of "short-turning" of cars at the option of the conductor, and the installation of autobus lines to supplement the tramcars.

Canadian Street Railway Association

The convention of the Canadian Street Railway Association, which was this year held in Hamilton, resulted in the election of the following officers:—President, Patrick Dubee, Montreal; Vice-president, C. B. King, London; Secretary-treasurer, Acton Burrows, Toronto; Executive: James Anderson, Windsor; E. P. Coleman, Hamilton; James D. Fraser, Ottawa; H. M. Hopper, St. John, N.B.; Wilson Phillips, Winnipeg, and A. Eastman, Kingsville.

The Fredericton Street Railway Company are at present negotiating with English capital, which it is hoped to interest in the project, and it is likely that development work will be proceeded with within the course of a month or two. It is proposed to construct an electric railway along the chief thoroughfares of the city of Fredericton, and also to build a line of railway across to St. Marys and Gibson, the complete circuit being about 5 miles. An extension of the line to Marysville is also under consideration. To operate the projected line it is proposed to employ the water power developed by the St. John River Hydro-electric Company, at Meductic Falls, 410 miles above Fredericton on the St. John River where there will be an initial development of 10,000 h.p.

Illumination

Street Illumination in Prince Albert, Sask.

Following the presentation of several petitions by property holders, the council of the municipality of Prince Albert, Saskatchewan, decided on June 24th, 1912, to substitute a five cluster tungsten light system for the old a.c. series arc lights in the principal streets, and a by-law to that effect was read twice in the council on that date. The by-law was subsequently advertised in the daily press of the city and no opposition developing the by-law was read a third time and passed on July 2nd. It was decided to put in 132 standard lights at a varying distance of 70 to 90 feet apart, this variation being necessitated by irregularities in the city survey plan. The City Commissioners, Mayor Morton, F. A. Creighton, C. O. Davidson, Ald. O. B. Manville, chairman of Light and Power Committee, and electrical superintendent R. Wright, selected a Roman Doric, No. 5 design Union Metal tungsten standard manufactured by the Union Metal Manufacturing Company, of Canton, O.

The following table indicates the location and number of the lamps installed to date:—

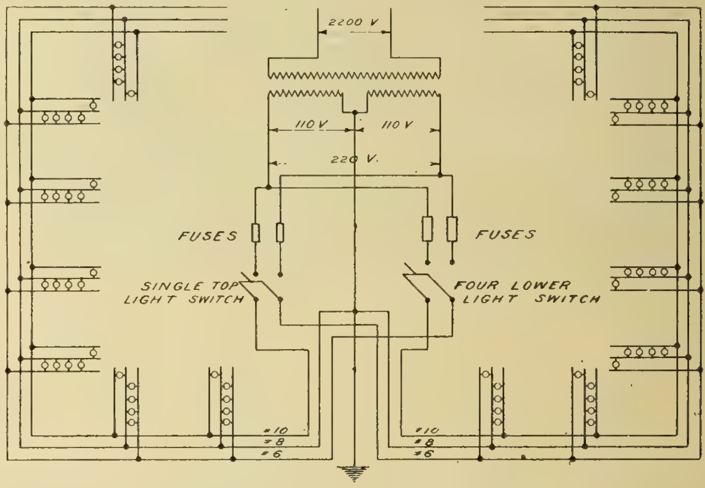
Centre ave., both sides, from River street to 15th St.,....	56
1st ave., both sides, River St. to 12th St.	20
10th St., both sides, from Centre Ave. to 1st Ave. W...	16
11th St., both sides, from Cent. Ave. to 1st Ave. W...	16
12th St., both sides, from Cent. Ave. to 1st Ave. W....	14
River St., South side, from Cent. Ave. to 1st Ave. W...	10

Erecting ornamental standards, Prince Albert.

At a total estimated cost of $16,800.

The tender of the above Company's standard, placed through their agents, the Canadian General Electric Company, was accepted. The Canadian General Electric Company also supplied the glassware, sockets and base switches, the total amount of the tender being $6,640 f.o.b. Prince Albert for 135 complete standards (without tungsten lamps). The glassware was manufactured by Gill Bros., of Steubensville, Ohio, the glass being their well-known Parian make. The top globes are 14 inches with 7-inch neck. The four lower globes are 12 inches with 6-inch neck. The lights used are 100 watt tungstens on the top and four 60-watt lights on the cluster.

Owing to the cement sidewalks being already laid where the standards were proposed to be erected, it was decided to use armored protected cable and lay same in a trench in the roadway gutter. The cable was laid 18 inches deep from the top of the sidewalk and 12 inches away from the curb. The order for the cable was given to the Canadian British Insulated Company, Limited, of Montreal. The cable is three conductor type, the size of the conductors being No. 6, No. 8, and No. 10 B. & S. gauge. The conductors are paper insulated, enclosed in lead sheath, protected by a double layer of flat steel tape, the steel being further protected by a treated jute covering. The trenching and laying of the cable was done by city workmen the cable jointing being done by men supplied by the cable company, the whole of the work being supervised by Mr. M. K. Davis, of the Canadian British Insulated Company's staff.



Wiring diagram of Prince Albert distribution.

The cables are looped into a pothead placed in the base of each standard, connections being taken from the pothead to the inside wiring of the standard. The system used is 220 and 110 volt three wire, the four lower 60 watt lamps being connected between the No. 6 and No. 8, and the single 100 watt lamp being connected between the No. 8 and No. 10, the No. 8 wire acting as a partial neutral. The control is from seven individual boxes on transformer poles, connected so that a transformer is balanced when feeding two cables, one each way around a block, and so that one double pole switch controls the lower lights on both cables and another double pole switch controls the single light as per diagram shown.

Trench digging and the drilling of the granolithic side-

Main street of Prince Albert, Sask., showing ornamental five-light standards.

walk, the latter being done by a compressed air drilling outfit, was commenced on October 15 and completed on November 8th, 11,020 feet of cable being laid, the linear length of trenches being 9,752 feet. The cost of digging, laying cable and filling in was 5.3c per linear foot, the force employed being an average of nine laborers for 21 days at an average rate of 27½c per hour. This was 5c per hour more than given the ordinary city laborer, but given on the understanding that the men were to be rushed in order to finish before the ground froze up.

The price of the cable was $4,518; the cost of cable jointing and supervision which was done on a cost plus 15 per cent. basis, was $1,003.61

The bases were distributed as soon as they arrived and placed over the potheads; English-speaking laborers were employed to level and bolt them to the sidewalk. Owing to the varying thickness of the concrete sidewalk, the bolts were cut to fit on the ground and the bases were levelled and tightened down. The heads were wired under the cover of a shed, before distribution, three men completing the erection with the aid of prepared trestles, see figure. All this work was done under the supervision of the Electric Light Department. The total cost of installation was $15,659.14 or an average of $118 per standard.

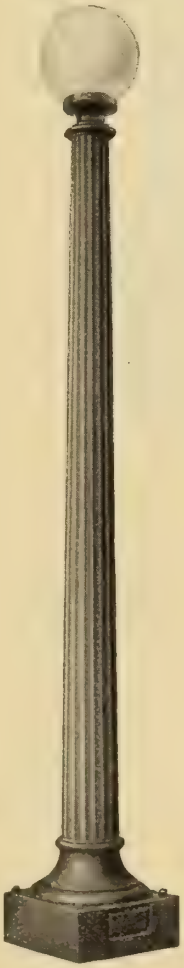
General satisfaction has been expressed at the appearance of the city, Central Avenue being spoken of as "The Great White Way," and some very favorable comparisons have been made by outsiders of the appearance, proportion and grace of the standards as compared with other cities having similar systems. It has been resolved to extend the work by another hundred lights this year and to gradually extend the system to take in the entire business portion of the city.

At the present time the lights are turned on and off by hand, the top light being allowed to burn all night, the four lower cluster lights till 12 p.m. It is proposed to control the top lights from the power station by solenoid operated switches placed in a series arc light circuit. The switch controlling the four lower cluster lights will still be turned off and on by hand. The department have a patrol man on duty from dusk to 12 p.m. and it has been decided to add the work of looking after the standards to his other duties.

Illuminating Engineering Society

At a recent meeting of the Convention Committee of the Illuminating Engineering Society it was decided to hold their next annual convention in Pittsburgh during the week ending September 22. It is expected that several hundred engineers from all parts of the country interested in lighting in its various forms will be present and the program, details of which have not as yet been completed, will consist, in addition to the technical sessions, of a reception and dance, several excursion trips and visits to various industries in Pittsburgh. Mr. J. C. McQuiston, of the Westinghouse company, is chairman of the publicity committee, and will make all arrangements for advertising the convention.

New Luxolabra Installations



During the first week in June lights were turned on in some 150 standards in the town of Galt, including the installations on Brant road, Lansdowne avenue, Wentworth avenue, Aberdeen avenue, and west Main street. These are one light Jandus Luxolabra, as shown in the accompanying reproduction. The equipment was supplied by the R. E. T. Pringle Company.

Further extensions in Galt are being made on Ainslie street between Colborne and Concession streets, on both sides of the road. These will be three-light Luxolabra. A petition is also being circulated and as soon as it is sufficiently signed the city council expect to begin the erection of lights on Main street. This installation will represent 75 or 80 standards, each carrying, probably, five lights.

A contract has recently been closed also, within the last few days with the town of Brockville. The Brockville installation will consist of fifty 5-light and twenty 3-light Luxolabra. This latter installation will be carried on under the supervision of Mr. E. J. Philip, formerly of Berlin, but now superintendent of the electrical department of the municipality of the town of Brockville. Among other installations which have been put in by this company, or at present under way, may be mentioned a 60 standard 5-light installation just completed in Kenora. The city of Winnipeg has also just completed the installation of 100 inverted arc Luxolabra, in which the C. G. E. magnetite lamp has been installed. The town of Smiths Falls are also considering the matter of ornamental lighting and expect to install this type.

Focusing Type Flame Arc Lamp

A new type of flame lamp known as the focusing type has recently been placed on the market by the Adams-Bagnall Electric Company, some illustrations of which we reproduce herewith. In this type, using a carbon ⅞ in. in diameter and 14 in. long, a life of from 100 to 120 hours is obtained.

The composition of the electrodes of all carbon flame lamps is more or less uniform. The electrodes consist of cored carbons, the core being filled with a mixture of finely ground carbon, generally in the form of lamp-black, with some salt. Originally common salt was used which gave a very yellow flame. Later calcium flouride was the salt more generally mixed with the lamp-black, these electrodes producing a reddish orange light of great intensity. More recent developments have shown that strontium and barium salts, and especially the latter, give very pleasing illumination results, though at the expense of efficiency. No electrodes have yet proven as efficient as those in which the core contains calcium flouride. The use of barium results in a much whiter light.

In the new focusing type flame lamp the composition has been so changed that it is claimed a mellower warmer and more cheerful effect is produced. The regenerative tubes, a feature of the former type of this company's lamp have been done away with and the condensing chamber is placed entirely above the arc. The gases in consumption circulate through this condenser in much the same manner as they formerly did through the side tubes. The upper and lower electrodes are both movable, so that the arc is always held in the same position. It is claimed that though the cost of flame carbons per trim is higher than metallic electrodes for luminous arc lamps, the extra efficiency of the carbon flame type reduces the operating cost to such an extent that over a year of say 4,000 hours, the total operating cost of the two lamps is approximately the same.

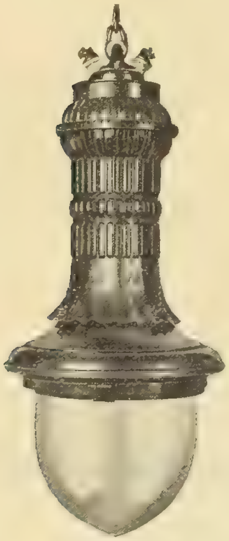


Fig. 1.

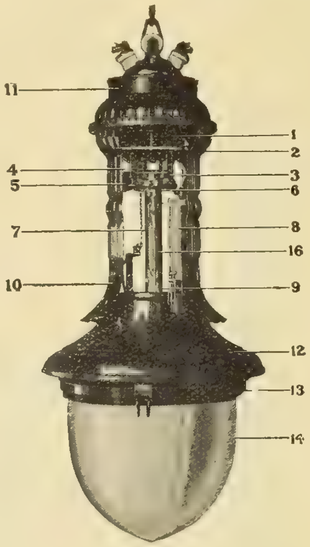
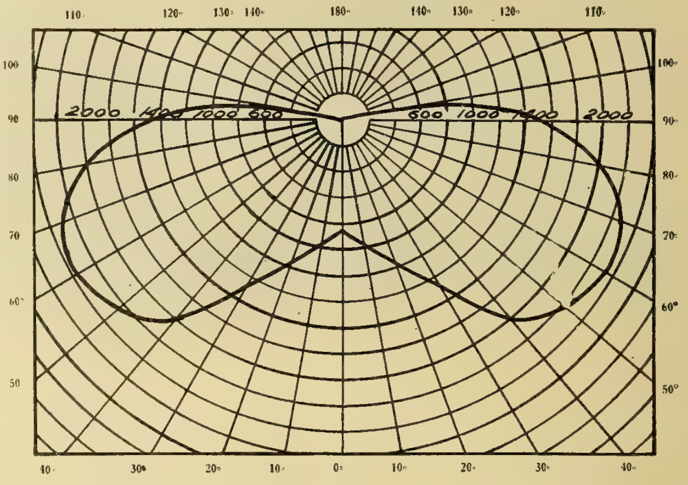


Fig. 2.

The new focusing type lamp is obtainable in different forms for operation with either alternating or direct current, series or multiple. The a.c. current lamp only operates satisfactorily on frequencies above 50 cycles and uses from 7.5 to 10 amp. at 100 to 110 volts. The standard direct current lamp operates at 6.6 amp. The different types of lamp are shown in Figs. 1 and 2.

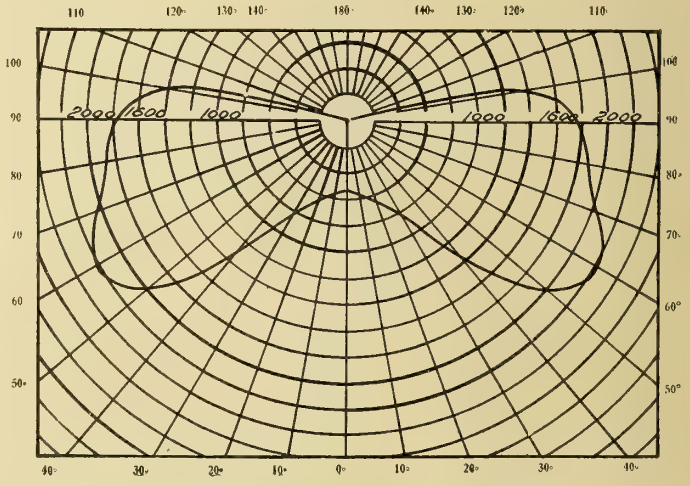
In Fig. 2 the mechanism can be understood by reference to the indices as follows:—(1) series solenoids; (2) shunt solenoids, opposite series; (3) walking beam; (4) series solenoid armature; (5) adjuster weight on walking beam; (6) series cutout; (7) slotted center tube; (8) starting resistance; (9) air pot; (10) copper case, removable panels; (11) ventilated top; (12) condenser; (13) outer globe band, (14) outer globe. An important feature of these lamps is that they operate on both alternating and direct current.

The operation of the lamp may be judged from the following typical electrical data referring to the series, alternating current, 7½ amp. type—terminal volts 87; terminal watts 450; power factor 75; life of trim 110 hours; for the lower electrode the stub of the upper is used; life of inner globe 1,000 hours; life of outer globe 2,000 hours; efficiency of the system 96½ per cent.; cost of lamp $40; cost of standard equipment per lamp $62.20; cost of electrodes 17c; cost of inner globes 50c; outer globes $1.25; trimming inspection per trim 5c.



Dist. curve of 6.5 amp. d.c. multiple type.

It is calculated that the cost of the maintenance of one of these lamps per year on a 4,000 hour basis amounts to $14.64 made up as follows:—cost of upper electrodes, $6.29; inner globes, $2; outer globes, $2.50; trimming and inspection, $1.85; repairs, $2. The fixed charges are placed at $18.39 made up as follows:—interest on investment, $6.13; depreciation, $10.22; taxes and insurance, $2.04. The total operating cost of a year of 4,000 hours therefore, amounts to $51.67, made up as follows:—energy cost at 1c per kw. hour, $18.64; maintenance, $14.64; fixed charges, $18.39; total, $51.67.



Dist. curve of 7.5 amp. a.c. series type.

The mean lower hemispherical candle power of this lamp is 1800, so that the cost per candle power per year is 2.87c. With the energy cost at any amount greater or less than 1c per kw. hour, the fixed and maintenance charges of $18.39 and $14.64 will not vary and the total will be just so much greater or less than the $51.67 given above.

Indirect Illumination in the Hub Clothing Store

Written from the viewpoint of a member of the firm who are proprietors of this store, the largest in the world handling men's furnishings

The retailing of merchandise at the present time is an entirely different proposition to what it was a few years ago. The modern mercantile establishment must not only have a complete and varied assortment of goods to offer, but it must give value in the fullest sense of the word. The equipment of the establishment must, therefore, develop in the highest possible degree a proper system of merchandise display so as to turn over the stock a sufficient number of times to make a profit. To this end merchandise must be properly displayed both in the windows and in the interior of the store; at the same time, every comfort and convenience must be provided for the customer. In addition to all this, sanitary and exhilarating surroundings promote the greatest efficiency and co-operation on the part of the working force.

Having in mind the aforementioned essentials and a full realization of the desirability of a change in lighting equipment from that which in the past had proven so unsatisfactory, we made a very exhaustive investigation and ran competitive tests in order to determine the most desirable method of general illumination for our new store recently erected at the north east corner of State street and Jackson boulevard, Chicago. Approaching the lighting question solely from the view point of the merchant, the following essentials were taken into consideration:—selling value; advertising value; impression of the passer-by; first impression upon entering; equipment design; cost; current consumption; cost of maintenance; depreciation and appearance of goods. The decision to install the indirect illumination was based upon the following conclusions, which decision seems to be justified.

Indirect illumination in Hub clothing store.

Selling Value—The attention is in no way detracted from the merchandise. By cutting down shadows, the false values in garments have been reduced.

Advertising Value—Indirect illumination gives the whole store the appearance of an immense show window, brilliantly illuminated with no exposed lights in view. After sun down the attention of countless numbers of people passing would, in consequence, be attracted to the store in a startling manner. They would receive a mental impression as to the location of the store that many times the same cost expended in any other way would not secure. Heretofore it has been impossible to attract attention above the ground floor but indirect illumination positively does this. Ordinary lighting appliances with numerous light sources or bright bowls seen from the street make an unattractive appearance and, if noticed, make one think of the fixtures instead of the store.

First Impressions—The first impression on one entering a store is of great importance. If illuminated with a general diffused light with not one exposed light unit inside, one can see clearly the whole interior at a glance as he enters. Signs, price cards, merchandise on display and departments, as well as individuals can be distinguished readily. The ceiling has the appearance of being higher than it actually is, the architectural lines being emphasized and not destroyed. With direct light or bright bowls the effect is undoubtedly the opposite. This is especially true of bowls of artistic design brilliantly illuminated where one's attention would be immediately attracted to the fixture. This is undesirable unless such goods are on sale.

Indirect illumination, sporting section, Hub clothing store.

Design—With indirect illumination specially designed bowls can be secured to harmonize with the interior, both in lines and color, and form part of the general scheme of decoration. This seems a very desirable feature and in marked contrast to semi-direct bowls which can be secured only in stock design.

Cost—In comparing the cost of specially designed indirect lighting fixtures it was found that these can be had at no greater cost than direct lighting fixtures. This, because the plastic material used in the bowls is less expensive than metal or glass used in direct or other classes of lighting equipment. Such fixtures, while not obtrusive, and which seem part of the general scheme, have an appearance of much greater cost than is actually the case.

Current consumption—The investigation showed that current consumption cost would be only slightly, if any, increased over satisfactory direct lighting. While the operating cost of all departments is of serious import the desirable results secured would make even an excess cost not of as great moment as it might at first seem. A slight increase in the efficiency of the employees under better working conditions of any kind will many times greatly offset the slight additional cost of operation.

Cost of maintenance—Any class of fixtures must of necessity be kept in repair and cleaned. By a systematic inspection and cleaning of indirect lighting fixtures our conclusions are that it is not more expensive to clean indirect lighting fixtures containing one-piece mirrored glass interiors, than translucent bowls or direct lighting fixtures.

We were led to believe by the actual experience of other institutions that this expense would be even less.

Depreciation—With any lighting system it would seem that the only depreciation is in the lamps. It is well recognized that the filament of tungsten lamps when encased in a reflector or a fixture that does not allow free ventilation rapidly deteriorates. By the use of inverted reflectors it would seem that the heat from the lamps would readily escape and keep their temperature down to a minimum.

Besides the above mentioned advantages of indirect illumination we find the following decided advantages: (a) The general diffusion of light throughout the store enables each employee to work in a very efficient manner in the selection of goods from shelving, cases, boxes, etc. (b) The absence of dark corners and recesses so common with direct lighting gives the impression of a clean and hygienic condition. (c) The absence of the brilliant exposed lights unquestionably conserves the nervous energy of each employee, eliminates head aches and is very desirable from a humanitarian point of view. (d) Fewer mistakes are made under these favorable lighting conditions. Work in general is greatly facilitated.

Many otherwise perfectly arranged and equipped stores of to-day are doing untold harm to their own working force and to the public they have, at great expense, attracted to their place, by almost criminally careless methods of lighting. There is no feature about our establishment that is attracting more favorable comment from our customers or from our employees than our lighting installation.

Delica White Glassware

The production herewith represents a type of pure white glassware manufactured by the Pittsburgh Lamp, Brass & Glass Company, and known as "Delica White." As its name implies this is a delicate white production of fine texture which is secured by the use of a very fine grade of plate glass. It is further claimed for this ware that it is distinguished no less for its dignified beauty than for its remarkable illuminating efficiency.

It will be noted that the design is after the exquisite contour of the pond lily. To more nearly reproduce the lily effect this company manufacture certain of their designs with colored leaves and it is said that with gas or direct electric lighting this lily tint is exceedingly beautiful. The company have recently issued catalogues illustrating and describing the different lines of glassware they manufacture.

W. E. Skinner, Limited, Consulting Engineers, have been engaged by the Town of Wolseley, Sask., to place a valuation on the plant of the Central Light & Power Company of that place, with a view to the town purchasing the plant.

The Jefferson Glass Company

The accompanying illustrations of handsome glassware are typical of the class of product being turned out by the Jefferson Glass Company, Limited, Toronto, Canada. This company has just issued a bulletin known as "Moonstone Bulletin No. 1" in which they describe with profuse illustrations, a number of their designs in illuminating glassware. The Moonstone is a semi-translucent glass of unusual efficiency and billiancy. It absorbs very little light, is a perfect diffuser, and gives a most artistic effect and high quality of illumination. This company is, we believe, the only one manufacturing illuminating glassware in Canada.

Strassburg Light Plant

The corporation of the town of Strassburg, Sask., have recently placed a contract for one 50 B.h.p. Ruston-Proctor gas producer and engine with the British Canadian Engineering Company, Limited, Winnipeg. The electrical equipment, including a 37½ kv.a. generator, 3-phase, 60-cycle, 2300 volts, together with exciter, switchboard, pole line and all accessories, also tungsten street lighting equipment, was awarded to the Canadian General Electric Company. The plant is to be in operation in September of the present year. The total cost of the above equipment exclusive of power house is $9,850.

The North Coast Electric Company, Limited, announce that they have taken over the business of the B. C. Holst & Company, and have established warehouses at No. 350 Water street, Vancouver, where they will carry a complete stock of apparatus and supplies. Though not completely stocked as yet, material is arriving daily and the firm report that they are in a position to fill orders promptly.

The Dealer and Contractor

New "Midget" Meters

The Keystone Electrical Instrument Company of Phila., Pa., has been perfecting for the past year a midget ammeter and voltmeter 3 in. in diameter, of the highest grade for use on switchboards, automobile dashboards, and for portable service where a small instrument is particularly desirable. In bringing out this instrument this company has endeavored to reduce the number of parts required in the standard d'Arsonval system to a minimum. It is a well known fact that the d'Arsonval principle is the most accurate for direct current measurements, and in order to reduce the cost of these small instruments, and at the same time produce a high grade accurate instrument much study has been given to this feature.

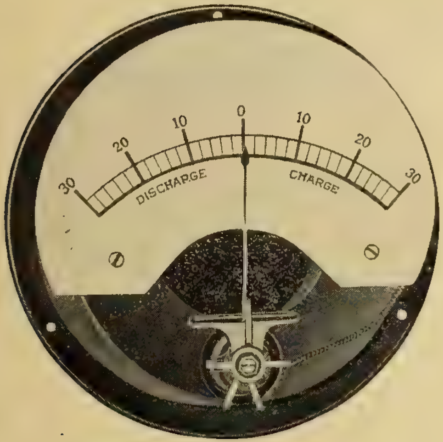


Fig. 1—Ammeter, cover removed.

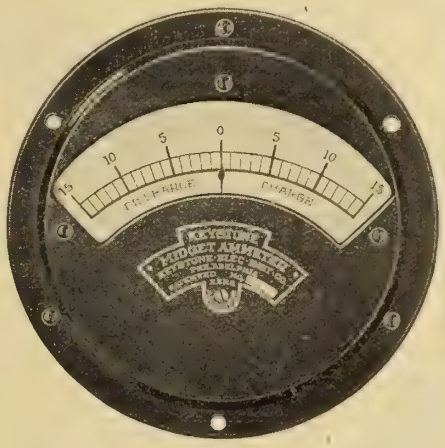


Fig. 2—Flush type.

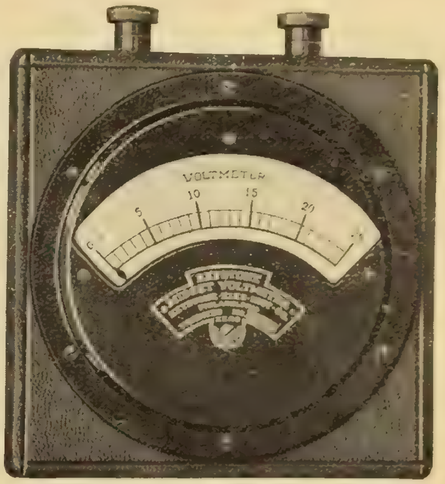


Fig. 3—Portable type.

Fig. 1 shows the board type ammeter, cover removed. The simplicity of construction will be evident at a glance. A tungsten steel magnet of unusually large size is used so that permanency can be secured, and also to increase the deadbeat operation of the instrument. This magnet has no pole pieces, the poles being accurately ground. This does away with the magnetic joint between the magnet and the pole pieces, and also increases the magnetic strength. The bases are of moulded material to insulate the studs carrying the current through the switchboard or dashboard, and this material is also used so that the magnetic strength may be unaffected. To obtain the greatest strength from the magnets the covers are also formed of brass instead of iron. All holes in the covers and bases are square so that there is no possibility of turning of any of the parts when tightened up. The aluminium coil form, seven thousandths of an inch in thickness, on which the fine enameled wire is wound, swings in sapphire jewels between the poles of the magnet. The pointer is of aluminium tubing twelve thousandths of an inch in outside diameter and with a wall one-thousandth of an inch thick, and the whole moving element weighs only slightly over one-tenth of a gram, or the weight of one common pin. With a moving element so exceedingly light as this the instrument is absolutely dead beat in operation, and the pointer does not oscillate, even if the instrument is subjected to severe vibration. This exceedingly light moving element also has the advantage that there is practically no weight whatsoever on the pivots and bearings, assuring long life for the instrument. The scale is white enameled on brass except where black scales with white letters are preferred. Each instrument is equipped with a zero adjusting device by means of which the pointer can be readjusted to zero at any time from the outside of the case.

In Fig. 3 is shown the flush type instrument 3¼ in. outside diameter, and in Fig. 4 the portable type, the instruments having a scale 2¼ in. long as shown in Fig. 5 which affords a clear legible scale for easy reading.

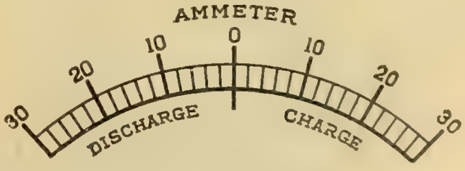


Fig. 4—Scale, full size.

On account of the design of the instrument with such a small number of parts, and on account of the large quantities in which it is possible to manufacture them this high grade instrument is being put on the market at a low cost.

This instrument is of particularly attractive appearance, being furnished in either dull rubber finish or full nickel plate, and it will prove of particular interest where a high grade instrument of small size is desired with an accuracy which can be relied upon.

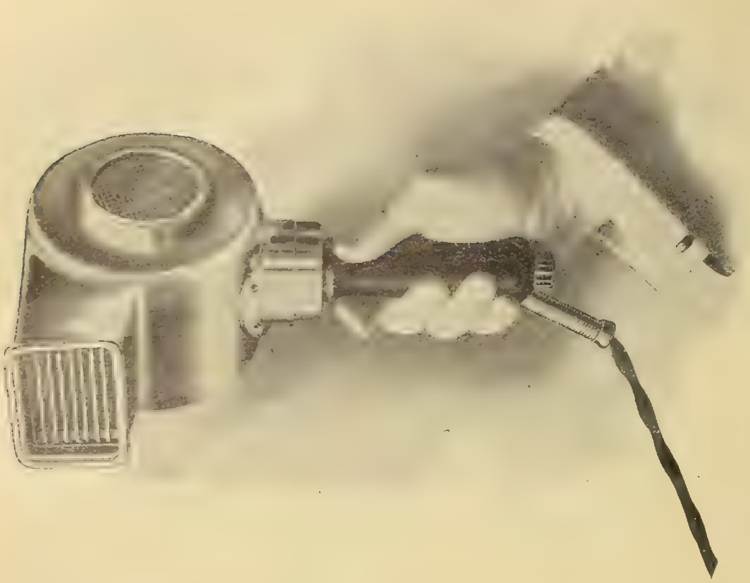


Fig. 1.

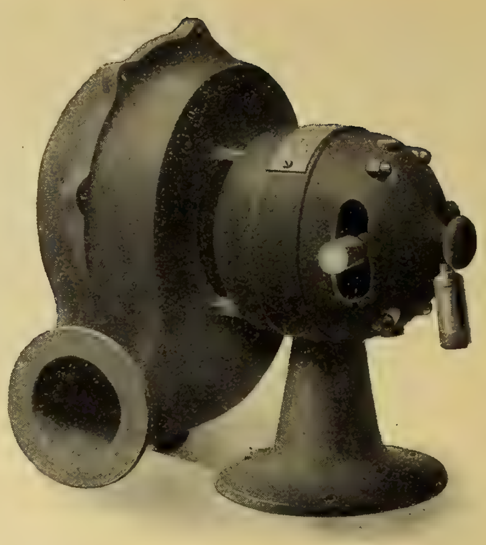


Fig. 2.

Small Motor Applications

The cuts shown herewith illustrate a few of the numerous articles manufactured by the Hamilton-Beach Manufacturing Company, for whom R. E. T. Pringle holds the Canadian agency. Fig. No. 1 represents a motor-driven hair dryer. The motor is of the universal type operating on either d.c. or a.c. current. The dryer will supply either hot or cold air as required, the hot blast being obtained by a simple turn of the switch which cuts in a heating coil over which the air must pass being forced by a small enclosed fan. Fig. No. 2 represents a small centrifugal blower operated by a 1/20 h.p. motor. This motor is also of the universal type and in addition to operating the blower may be used for any household general utility purpose. Fig. 3 illustrates this company's latest type of solid cast aluminium vibrator, also equipped with universal motor which can be operated off any live circuit of the proper voltage. Fig. No. 4 shows their latest type of bench and tool-post grinder. This grinder, we understand, has met with exceptional favor among electrical contractors, as it may be used to advantage for sharpening augers and drills, for commutator grinding, for grinding small castings, etc. Fig. 5 illustrates the latest type of ¼ in. universal Van Dorn and Dutton portable electric drill also handled by this Canadian firm.

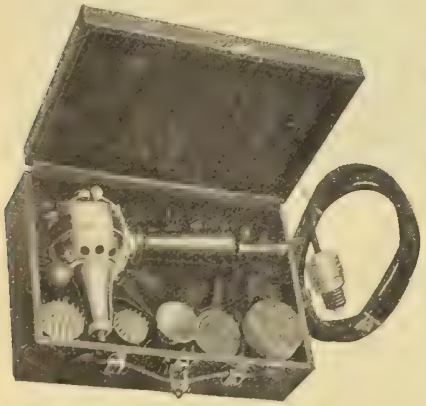


Fig. 3.

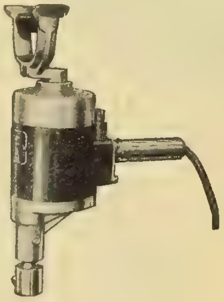


Fig. 5.

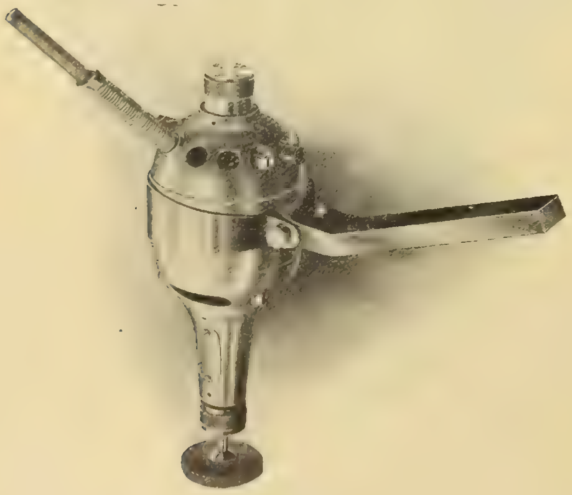


Fig. 4

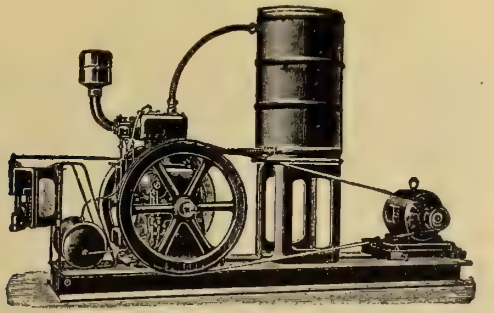
Good Electrical Exhibit

As illustrating the possible scope of the modern electrical display, the following exhibit by one of the largest manufacturing companies and its subsidiaries at the Chicago Convention of the N.E.L.A. is interesting.

The exhibit consisted of several general utility motors and those for general household, office and store use. A complete line of heating apparatus for domestic and industrial uses, including toaster stoves, disc stoves, irons, coffee percolators, frying pans, chafing dishes, sterilizers, luminous radiators, air heaters, saute pans, heating pads, milk warmers, tea samovars, tailors' irons, soldering irons, automobile tire vulcanizers, solder pots, liquid heaters, glue pots and chocolate warmers. Fan motors of all kinds showing new, and remarkably light and efficient drawn steel frame fans for use on a.c. and d.c. circuits; 8-in., 12-in. and 16-in. desk and bracket, and oscillating types, also different styles of exhaust fans. Ozonizers for purifying the air, one of black and one of enamel finish. A rack containing a display of insulating materials. A solder which only requires a match. Quartz lamps and arc lamps of the flame carbon type for operation on a.c. and d.c. circuits, multiple and series. A battery charging mercury rectifier outfit with a time switch for ending the charge at any pre-determined time. A mechanical (vibrating) rectifier for charging ignition batteries. A bell ringing transformer and distributing transformers of 5 and 7½ kv.a. capacity with fuse blocks; a switchboard panel with a complete equipment. Meters of all kinds, indicating, watthour, graphic and precision. Carbon circuit breakers, from 12½ amperes to 6,000 amperes capacity and oil breakers as high as 44,000 volts. Condenser type terminals, arresters, lamps, etc.

Small Electric Light Plants

The need of small electric light plants for supplying light and a limited amount of power to isolated buildings, such as country hotels, country homes or small villages, has long been recognized, but it has been difficult to supply a unit of the necessary small capacity at a price which would bring it within the reach of the average customer. Further difficulty has been met in the operation of the plant, the limited capacity not justifying the employment of a skilled engineer. A solution of this difficulty is now claimed by the R. A. Lister Company, who manufacture and install lighting equipments varying in capacity from .5 kilowatts to 6 kilowatts, operating at 60 volts with a speed of 400 to 500. The smaller units consist of a gasoline engine belt connected to the generator, but the larger units are direct connected.


Small isolated plant.

In connection with the plant there is also a storage battery which floats on the line in parallel with the lighting installation, and so is always fully charged. This battery is used exclusively for lighting or small power requirements at off peak hours, as for example, during the night, when only one or two lamps may be required. It is also used for starting the engine which is done by using the generator as a motor until such time as the engine comes up to speed.

The engine starts and stops automatically as the lights are turned on or off. This means that if more lamps are turned on than the battery is able to carry, the current taken from the battery is sufficient to operate the motor and start the gas engine running. The reverse is also the case when the lights are gradually turned out. Such an installation should be of the greatest value to small towns, country homes, hotels, country clubs, churches, etc. That this is being found the case is evidenced by the fact that between 400 and 500 of these engine-generator equipments are at present operating in Great Britain, and that, though this equipment has been on the Canadian market less than twelve months, there are already between 30 and 40 satisfactory installations at different points in Canada. The illustration is typical of one of the small units. The large tank represents a water cooling arrangement, the gasoline tank being shown to the left of the figure.

Canadian Allis-Chalmers, Limited

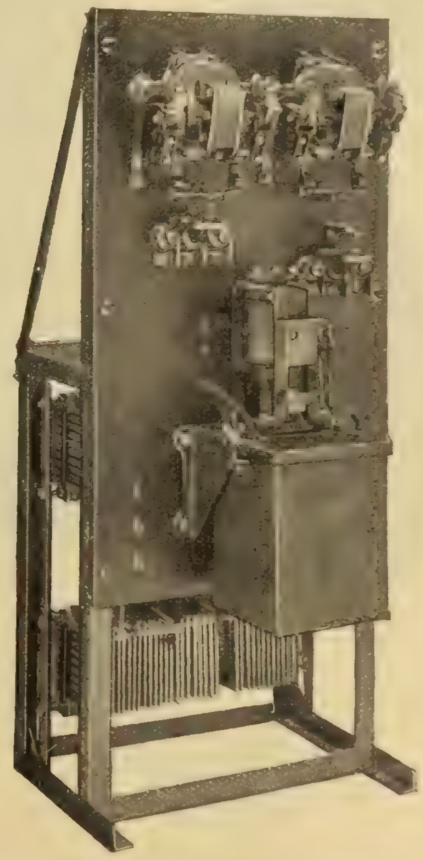
The Canadian General Electric Company, Limited, who own and control, as subsidiary companies, the Canada Foundry Company, Limited, and the more recently acquired Canadian Allis-Chalmers, Limited, have decided to consolidate the selling organizations of the two latter companies, dropping the name "Canada Foundry Company, Limited," and conducting the selling organizations of both companies under the name of "Canadian Allis-Chalmers, Limited."

This policy has been adopted because the name Canada Foundry Company does not appropriately cover the wide range of mechanical apparatus manufactured by that company, whereas the name Allis-Chalmers is synonymous with a very wide range of mechanical appliances and engineering works of magnitude, particularly in the manufacture of Corliss engines, water wheels, saw mill machinery, mining machinery, cement machinery, flour mill machinery, gas engines, etc., and these lines will naturally be complementary to the products of the Canada Foundry, such as steam locomotives, hydraulic machinery, pumping machinery, structural steel work, etc.

Hereafter all sales of electrical apparatus and supplies will be in the name of the Canadian General Electric Company, Limited, and all general engineering contracts and sales of mechanical appliances in the name of Canadian Allis-Chalmers, Limited.

Automatic Controllers For High Voltage Motors

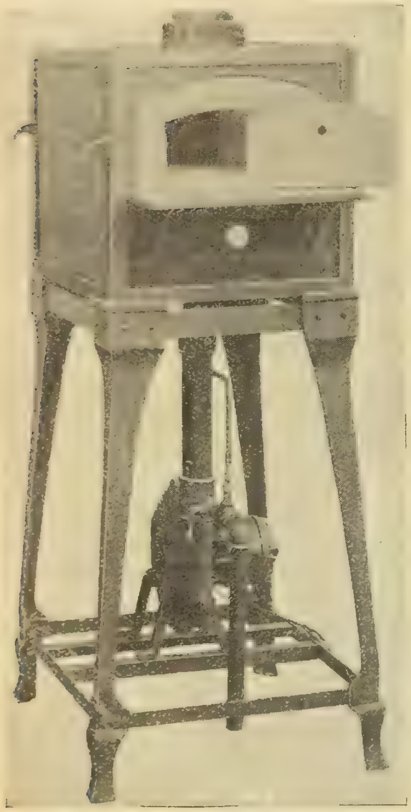
Motors connected directly to 2200 to 1100 volt systems are now coming into general use in large plants, for waterworks service, etc. At this high voltage it is especially desirable to provide automatic starting apparatus. For this purpose the Cutler-Hammer Manufacturing Company of Milwaukee, has designed a new line of high tension automatic control panels. One type is designed for use with motors driving reciprocating pumps, air compressors or other machines which must be started under full load conditions, and which require a starting torque equal to or in excess of the normal full load torque of the motor. The other line, having the same appearance as that shown in the accompanying illustration, is designed for use with motors driving centrifugal pumps, or machines of similar load characteristics, starting under light load conditions. The acceleration is controlled by resistance in each of the three phases of the rotor which is cut out step by step by double-pole magnetic switches under the control of current relays. By adjustment of the relays the starting current can be set at a predetermined value and the motor accelerated in the shortest time consistent with this current. An oil-immersed sole-


Automatic starting panel for high voltage motors.

noid-operated three-pole switch is also mounted on the panel which controls the high tension motor primary circuit. Where used on water systems, air or vacuum systems, suitable accessories such as float switch, gauge and diaphragm type pressure regulators and vacuum regulators are available.

Motor-Driven Blowers for Gas Furnaces

An improvement has recently been made in gas furnaces by forcing the air into the gas by means of a motor driven blower instead of merely allowing the air to flow in through valves as with the familiar Bunsen burner and gas stove. This forced draught permits a much higher heat, thereby increasing the efficiency of the furnace, extending the range of work it can handle, and making its production more rapid. It is claimed, for example, that a temperature of 2,500° Fahrenheit can be obtained with an air blast furnace whereas 1,800° is about the maximum for a similar furnace without the blast. This principle has been applied to furnaces for many lines of industry, such as candy furnaces, rivet heaters, muffle furnaces, etc. The illustration herewith is manufactured by the Improved Appliance Company, Brooklyn, N.Y., Westinghouse motors being used for driving the blowers.



Small motor application.

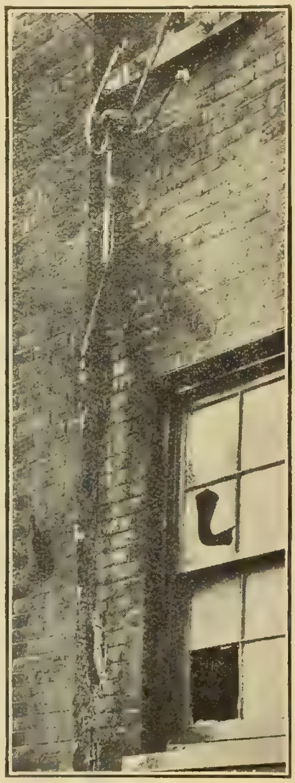


Fig. 1.

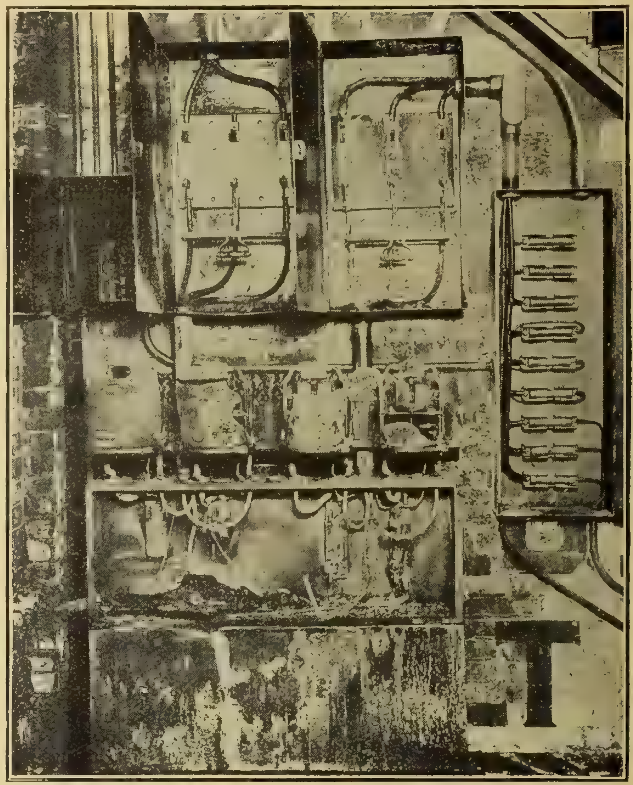


Fig. 2

Herbert Morris Crane & Hoist Company

A Dominion charter has recently been granted to The Herbert Morris Crane & Hoist Company, Limited, Peter St., Toronto. The new company will continue the Canadian business of the well-known English company, Herbert Morris Limited. We understand that the formation of a separate Canadian company was made necessary by the rapidly growing demand for Morris lifting and shifting machinery, and that the new concern will manufacture Morris products in Toronto. Herbert Morris, the president of the English company, will also be president of the new Canadian company, and he will be supported by a strong board of directors.

Efficient Service Protection

The best practice in electrical installation has come to look on proper protection from lightning or other disturbances as the best possible kind of insurance, not only against fire, but also against breaks in the continuity of service which are often disastrous in an establishment of large dimensions. The accompanying reproductions are typical of the results where proper protection has not been installed. Fig 1 shows a burnout in a service conduit running outside a factory, and Fig. 2 shows, indistinctly, the trouble caused in the cut-out cabinet inside the same building. This accident was the cause of a big delay in the work of the factory, meaning loss to the employees, manufacturer and consumer alike. The solution of such difficulties is a proper protection placed on the service wires outside the building. The Crouse-Hinds Company of Canada manufacture what is known as type F. F. condulet to meet this particular requirement. This is a weather-proof cast iron fuse box of special design which has the endorsement of the National Board of Fire Underwriters. This company claim that the above burnout could not possibly have happened if their type F. F. condulet had been installed. It is better by a small expenditure to prevent costly interruptions in the power supply than to incur a much greater expenditure by an accident.

Under the reorganization of the business of Mr. W. N. Dietrich, electrical and mechanical engineer, Read Building, Montreal, the scope of the undertaking has been enlarged. The company is known as Dietrich, Limited, and undertakes conduit installations, transmission lines and power plants, and heating. The president is Mr. W. N. Dietrich, who was formerly electrical engineer for the C. P. R.'s entire system, while the vice-president is Mr. G. E. Templeman, previously superintendent of construction in the engineering department of Allis-Chalmers-Bullock, Limited. The company are now carrying out some extensive electrical work in the provinces of Quebec and Ontario.

Automatic Trolley Guard

The automatic trolley guard illustrated herewith has recently been added to the line of equipment sold by the Electric Service Supplies Company. The guard is placed over the trolley wire usually at cross-overs intersecting steam and electric lines to automatically replace the pole when it leaves the wire. In doing this, it eliminates the danger of cars being stalled directly in the path of an approaching steam train. It is claimed by the manufacturer of this trolley guard that it will positively keep the pole on the wire, and that in a case where the pole is held down by the rope being caught, it is only necessary to release the rope and let the automatic guard immediately replace the pole. This guard not only assures a continual supply of current to cars passing through danger zones, but finds effective use on railways operating through tunnels, under grade crossings, bridges, dark sheds or at any point where it would be difficult to replace the pole on account of darkness or other objections. The simplicity of construction and the ease of installing the automatic trolley guard can readily be seen in the accompanying illustration. It consists principally of two aluminium coated steel sheets which are held in place by pressed steel yokes or hangers. These hangers are adaptable to any standard type of trolley car. Its simplicity does away with all projections or obstructions which could in any way prove a hindrance in the path of the trolley wheel and allows a free vent for gases from passing locomotives. It is also designed to eliminate the possibility of choking up from any combination of ice, dirt or soot. All the metals used in the construction of this trolley guard are impervious to the action of all elements with which they come in contact.

Guard in operation.

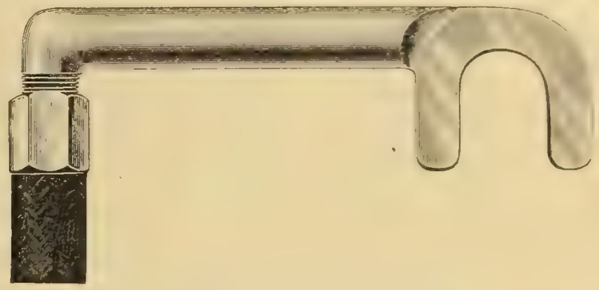
Method of suspending automatic trolley guard.

Roper, Clarke & Company

Messrs. Roper, Clarke & Company, manufacturers agents, Montreal, recently received an order from the city of Regina for a 1200 kw. Peebles motor-converter. This is said to be the largest machine of this kind in Canada. The same company have recently secured from the Garth Company of Montreal, orders for 20 a.c. motors varying in sizes from 2 to 24 h.p.; these are for installation in the Montreal high schools. Orders have also been received for several motors for the Art Association galleries, the new Royal Trust Building, and several other of the Montreal schools. Roper, Clarke & Company are distributing two pamphlets Nos. 16 B and 21B, describing d.c. motors and generators and a.c. motors. These pamphlets draw particular attention to the manner of construction of the rotors of the a.c. motors, particularly as to the form of design of the short circuiting rings. This company announce that they have also secured the agencies for the Independent Electric Company, Milwaukee, manufacturers of switch gear, and of the Premier Accumulator Company of Northampton, manufacturers of storage batteries.

New Dossert Rheostat Terminal

A new Dossert terminal connector which has been substituted for the old screw type terminals for making the connections from the dial to the grids of field rheostats in one of the largest power generating stations of the Metropolitan district is shown in the illustration. The shank of the connector is elongated so as to admit the cable in a direct line while the contact disc is slotted to fit over the grid and is offset slightly to the right or left respectively to facilitate the work of installation. The cable is held in the connector by the compression method characteristic of all types of Dossert connectors.



Handy rheostat terminal.

Colored Glass Lamp Hoods

The Reynolds Electric Flasher Manufacturing Company have recently placed upon the market a lamp hood or shade, which slips over an incandescent lamp bulb and is securely held in place by an ingenious fastening, and is both weather-proof and fool-proof. The hoods are made in all sizes to fit the 2½ watt, 5 watt, 10 watt, 20 watt, 25 watt and 40 watt mazda lamps, also the 10 watt and 50 watt carbon lamps or any bulbs styles S14 or S19. The hoods are made of natural colored blown glass in six colors. The hoods slip over the lamp bulb easily and may be removed just as easily in case of burnouts. These hoods are used extensively in spectacular electric signs and displays, for exit lights, elevator signals, canopy lamps and for decorative purposes of various description. Artificial coloring will fade, crack and wash off; also, either a natural or artificial colored lamp bulb has not the life of a clear lamp, engineering tests having proven that colored bulbs impair the life of the filament. Lamp hoods, on the other hand, permit the use of clear lamps and also provide for an air circulation around the bulb, so the life of the filament is not shortened. These lamp hoods appear to be a satisfactory and inexpensive substitute for lamp coloring.

Colored Lamp Hood.

P. & S. Lamp Receptacles

We illustrate herewith three Pass & Seymour lamp receptacles. Fig. 1 is a new porcelain cleat receptacle with shade holder groove to take standard porcelain socket shade holder. The same receptable is manufactured without the groove. Fig. 2 is a receptacle which may be used either on concealed work or on many of the Crouse Hinds condulets. Fig. 3 is what is known as an electrolier socket with flutolier shell. This is a reduced size of the standard pull socket and is intended for use with fixtures only. They are considerably smaller than the standard socket thereby permitting a more artistic effect in high priced fixtures.

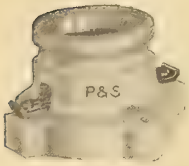


Fig. 1.

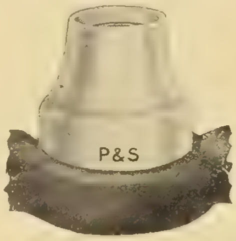


Fig. 2

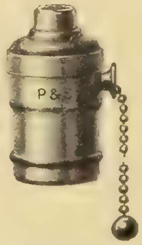


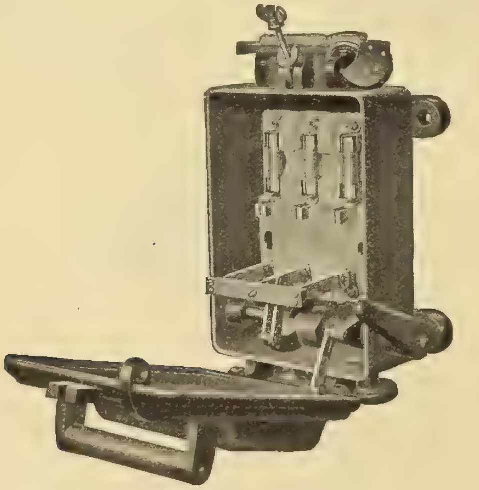
Fig. 3

"D. & W." Fused Switch Boxes

To meet the demand for an improved, combined switch and fuse box, the D. & W. Fuse Company of Providence, R.I., have brought out a new line of fused switch boxes for 250 volt d.c. circuits. These boxes are particularly adapted for mill service since they may be permanently locked after the fuses are installed, thereby preventing any tampering with the connections or increasing the capacity of the fuses. At the same time, they can be used as a switch since the circuit can be opened or closed at will by simply moving the lever at the side of the box. By referring to the illustration you will note that when the cover is opened the circuit is likewise opened, which makes it impossible to re-fuse the circuit when the switch is closed.

In designing these boxes they have introduced no complicated mechanism, but have used a very simple but substantial construction which will give indefinite service, since the operation of the switch is not dependent on springs.

These boxes are provided with rubber gaskets which render them positively waterproof provided that the terminal wires are taped in at the bushings or protected by outlet hoods when conduit connections are made. To facilitate installing these boxes removable porcelain bushings are used through which the cable terminals may be readily passed.



Fused Switch Box.

Trade Publications

Glassware—The Pittsburgh Lamp, Brass & Glass Company have just issued two handsome catalogues called Delica White Lighting Glassware and Cased Green Shades for Gas and Electric Lighting. These catalogues are well illustrated showing this glassware in their proper colors.

Pneumatic Tools—Bulletin 128 on Miscellaneous Equipment for Pneumatic Drills; No. 123 on Pneumatic Motors and Pneumatic Geared Hoists, and No. 133, Cylinder Air Hoists and Jacks; published by the Chicago Pneumatic Tool Company.

Peebles Dynamos and Motors—Pamphlets No. 16B and 21B, issued by Roper, Clarke & Company, Canadian agents, describing, respectively, Peebles alternating current motors of the polyphase induction type and Peebles continuous current dynamos and motors.

Rectifiers—Bulletin 100, by the Wagner Electric Manufacturing Company, St. Louis, descriptive of alternating current rectifiers, for use in charging batteries up to capacities of 15 amperes, 10 volts, and 7½ amperes, 12 volts. The principle of this rectifier is also described in the bulletin.

O-B Products.—The Ohio Brass Company have issued bulletins descriptive of their type J. all-wire rail bonds and of their fire hose-bridge and trolley pick-up. To these bulletins are attached postal cards by the use of which enquiries may be made with a minimum of trouble to anyone interested.

Rolled Steel Wheels—The Standard Steel Works Company, Philadelphia, has issued a new catalog on Rolled Steel Wheels. An interesting feature is the application of a number to each wheel, which number covers all standard dimensions except the bore. The process of manufacture is fully described with many detail illustrations. The standard sized axles for steam and electric service are also shown.

Watt-Meter Boxes—The Appleton Electric Company, Chicago, Illinois, has issued a complete booklet listing and describing their complete line of watt-meter boxes from 1 to 30, 31 to 60 and 65 to 100 amperes. Watt-meter boxes are approved by the National Board of Fire-Underwriters, and are approved and used by the city of Chicago in all apartment, store and office buildings.

Rolled Steel Wheels—Catalogue No. 12 issued by the Standard Steel Works Company, Philadelphia, descriptive of their solid forged and rolled steel wheels. "Standard" wheels are made from acid open hearth steel which is of uniform composition and with a given carbon content has a higher tensile strength and elastic limit both in tension and compression than basic steel, and is therefore superior for use in wheels which carry heavy loads and are subjected to much wear. The illustrations indicate the variety of equipment under which these wheels have been successfully used.

Theater Dimmers—In a new 24-page bulletin The Cutler-Hammer Mfg. Co. describe the latest type of Simplicity theater dimmer for two-wire and three-wire circuits. These dimmers are made especially for use with tungsten lamps and where an extremely fine regulation of the lamp briliancy is desired. There are twice as many steps on the new plates as on the dimmer for carbon filament lamps. The diameter of the plates has also been increased two inches and two complete resistance windings can be carried on each side of the plate. These plates, however, can be carried on the same frame as the smaller ones. The bulletin contains very complete description and has many illustrations. Means of banking and control are discussed and dimensions given. The new Medinah Temple and Auditorium of Chicago and a number of eastern theaters have already been equipped with the dimmers described in this bulletin. Bulletin 8515 describing Spot Light dimmers is also being distributed.

Current News and Notes

Ashcroft, B.C.

The Atlas Power Company, Limited, has been incorporated with head office, Ashcroft.

Amherst, N.S.

The electric light station at Amherst, N.S., is reported to have been totally destroyed by a recent fire.

Battleford, Sask.

During the reorganization of the local power plant, energy will be purchased from North Battleford at the rate of 9c per kw. hour. Machinery for the Battleford power station has not yet been purchased.

Bowmanville, Ont.

The R. G. Sturgeon & Company are in the market for an equipment capable of lighting about fifteen 25 watt tungstens at a pressure of about 40 volts.

Brandon, Man.

The city council has voted to place the city of Brandon under the jurisdicton of the Public Utilities Commission of the province. This means that all public utilities within the municipality of Brandon whether municipally or privately owned come under the jurisdiction of this commissioner. These utilities include the street railway, the waterworks and sewers, the electric light company and the gas company.

Brantford, Ont.

The street car employees have received an increase of wages, the maximum being now placed at 20c instead of 17c per hour.

Carlyle, Sask.

The John Galt Engineering Company have submitted a report on the cost of a municipal light and power generating and distribution system. The report suggests an installation of a 35 kw. a.c. generator. The scheme also allows for the installation of fourteen streets lights. The cost of the system is placed at $12,400 and it is estimated that on a 15c rate the revenue should be $3,300 annually. An alternative proposition has been submitted by the R. A. Lister Company, whose price is approximately $7,000.

Chase, B.C.

The Adams River Lumber Company are installing an additional 60 kw., 1,000 volt generator to be belted to the line shaft in their saw mill for auxiliary use when on double shift. The generator is being manufactured by the United Electric Improvement Company of Philadelphia.

Edmonton, Alta.

Grading work has commenced on street railway extensions.

The city of Edmonton at the present time are spending between $200,000 and $300,000 in ornamental street lighting, the type of lamp used being the C. G. E. inverted arc.

The city of Edmonton have recently placed an order for a 100 kw. steam driven exciter set with Mr. F. S. B. Heward, Montreal agent for Jas. Howden & Company, Glasgow. The engine is to be of standard two-crank compound high-speed type operating at 500 r.p.m. under steam at 140 lbs. The dynamo will be supplied by the Electric Construction Company and will be a shunt wound continuous current multipolar type. Other Canadian installations made by this company recently, include two engines for the Canada Iron Corporation at Midland, one for the Robt. Simpson Company, Toronto, one for the Montreal General Hospital, and one for Nanaimo, B.C.

Fredericton, N.B.

The annual report of the New Brunswick Telephone Company shows that the total number of instruments installed is 12,915 being an addition of 1,624 for the year 1912. During the same time 114 miles of rural circuits have been constructed. It has been decided to establish an exchange at Gagetown to accommodate thirty-five telephones. The net revenue for the year was $88,681.

Galt, Ont.

The Galt water system is now being operated electrically. The electrical equipment consists of a 250 kv.a., 2200 volt, 25 cycles, 750 r.p.m. motor supplied by the Swedish General Electric Company.

Goderich, Ont.

The Ontario railway board are holding a preliminary investigation into the financial condition of the Ontario and West Shore railway. This is the line that was intended to be operated electrically between Goderich and Kincardine. It is said that certain moneys guaranteed by the municipalities, or by the farmers more directly interested, cannot be accounted for.

Hamilton, Ont.

In connection with a recent report that the Dominion Power & Transmission Company would commence the construction of a suburban electric road between Hamilton and Galt in the near future, we learn that, though preliminary surveys have been made and that the line will undoubtedly be built in the near future, it is not probable that work will be commenced this year.

The City of Hamilton are considering the proposition of installing the largest electrical sign on record, advertising the City of Hamilton by the words "Hamilton Cheap Power." The actual dimensions are not yet decided upon but by using the 300 ft. elevation of the mountain together with a reasonable elevation of the sign it is expected to have the advertising feature visible for many miles.

Hull, Que.

The Hull Electric Company gave considerable encouragement to the young ladies who collected for the hospitals in Hull on Tag Day, May 17th. Besides giving a cheque for $20 to the Hull hospital the company entertained the workers at luncheon in the waiting room on Main street.

Kamloops, B.C.

A by-law was carried on June 3rd, to expend $260,000 on the erection of a hydro-electric power plant on the Barriere River, some 40 miles north of the city.

A by-law authorizing the expenditure of $120,000 to extend the electric lighting system carried on June 3rd.

The Marcus Electrical Company, Limited, has been incorporated with head office at Kamloops, B.C.

Melita, Man.

By a vote of 123 to 1, the ratepayers of Melita on May 17th, granted a franchise to Mr. R. E. Denny for the supply of light and power in the town. Mr. Denny promised in case the franchise were granted, that he would make a reasonable test for gas in the district, and in the case of it being discovered in merchantable quantities an electric light and power plant will be installed. The by-law also grants Mr. Denny the right to install a waterworks system and a street railway system, a term of years being allowed in each case.

Medicin Hat, Alta.

The provincial government will erect a three-storey telephone exchange building with provision for 10,000 subscribers The installation will be the automatic system.

Minnett, Ont.

Mr. Arthur Minett, proprietor of the Cleveland House, is installing a gasoline electric plant. The equipment is being supplied by the R. A. Lister Company.

Morrisburg, Ont.

A by-law will be submitted in the village of Morrisburg granting a right-of-way along certain streets in the municipality for the operation of a railway by the Ottawa and St. Lawrence Electric Railway Company.

Montreal, Que.

In connection with the widening of the aqueduct, Montreal, and the generation of ten thousand horse power, four thousand of which will be utilised for lighting the city, eight tenders have been received. The lowest is by the Cook Construction Company, Limited, of Sudbury, Ont., the price being $2,322,562. This includes the construction of two boulevards, on which it is proposed to run lines of tramcars. The whole scheme has been attacked on the ground that the city is able to secure electrical power from companies cheaper than it can be generated under the aqueduct scheme, and that the latter is not a commercial proposition. In addition to the higher cost of power, which is put at $36.55 per horse power per annum for lighting, there will be heavy charges for distribution. The city officials reply that they have taken expert advice from Canadian and U. S. engineers, and that the cost to the city, having regard to the saving of coal and other charges, will be $12.62 per horse power.

The Montreal Council have given the Montreal Tramways Company permission, until further notice, to haul freight.

The Cedars Rapids Manufacturing and Power Company have been given leave to appeal direct to the Judicial Committee of the Privy Council from a decision by Mr. Justice Davidson in connection with the expropriation of certain islands belonging to the De Beaujeau estate situated near Cedars Rapids. The company offered $4,700 for the islands, and this was confirmed on arbitration, but Mr. Justice Davidson ordered the payment of $142,000 for one of the islands, the expropriated rights on another, and another was left over for a further award. The judge held that the proprietors should be paid not only for the value of the land but also for the hydraulic rights and possibilities. The company object to the manner in which the values were arrived at.

An action by Mr. D. Robertson, purchasing agent of the Montreal Tramways Company, to prevent the carrying out of a contract between the Canadian Autobus Company, Limited, and the City of Montreal has been dismissed. An appeal, however, is to be made against the judgment of Mr. Justice Demers in the Supreme Court. The action was to stop the running of autobuses.

The Montreal Light, Heat and Power Company have reduced the price of lighting from 7c per kilowatt hour nett to 6.40c nett. This is the sixth consecutive annual reduction. The company state that the new rate applies only to aerial and overhead service. Underground service, such as is now being planned by the city under taking to place all wires in conduits and charge the various companies rental for the same, will prove more expensive, and the present rates will have to be adjusted somewhat in the districts where the conduits are laid.

J. Stone & Company, Limited, an English firm, have written to the Maisonneuve, P.Q., Council, stating that they propose to construct a large electrical engineering factory in the precincts of the city, and asking what concessions the Council will give them. The secretary-treasurer was directed to ascertain full particulars regarding the proposed building and the number of workers to be employed.

Five Canadian representatives were present at the Annual Meeting of the Association of Railway Telegraph Superintendents at St. Louis, Mo., which was the largest attended gathering in the history of the Association. The Canadian representatives were Mr. W. J. Camp, assistant manager of the C. P. R. Telegraph Department, Montreal; Mr. Richardson, superintendent of the B. C. division of the C. P. R. Telegraph Department; Messrs. W. Ashald and T Rogers, of the Grand Trunk Telegraph Department; and Mr. A. D. Smith, of the Northern Electric & Manufacturing Company. Mr. Richardson and Mr. Camp took part in the discussion. The next meeting will be held at New Orleans in May, 1914.

Newmarket, Ont.

By a small majority, a by-law authorizing the franchise contract between the town of Newmarket and the Toronto and York Radial Railway Company was defeated. As a result of their conviction that it would be very unwise, under the circumstances, to install Hydro-electric power, the council later resigned in a body.

Orillia, Ont.

Mr. W. K. Greenwood, city electrician, has submitted a report on the lighting of the main street. The report provides for the use of five-light ornamental standards on both sides of the street. Separate estimates have been made of the cost of overhead and underground service wires.

Ottawa, Ont.

The supplementary estimates contain an item of $75,000 for the rewiring of the Parliament Buildings. Much of the wiring of these buildings has not been in conduit and as a result the fire hazards are unnecessarily heavy.

Owen Sound, Ont.

The revised report of the Hydro-electric Power Commission of Ontario with regard to the cost of power in Owen Sound shows that, including distribution, the cost to the consumer would be approximately $40. This is against the present calculated cost of $50 per h.p. year with steam equipment. If it is the wish of the council the Hydro-electric Commission is ready to proceed with the development of Eugenia Falls.

Pelee Island, Ont.

A telephone system is contemplated. A committee has been appointed to look into the matter.

Port Coquitlam, B.C.

A syndicate of local business men are considering the establishment of a private telephone system to serve the residents of the town, as a result of dissatisfaction with the present service. It has been suggested that the automatic system will be installed.

Prince Albert, Sask.

Plans and specifications are being prepared for a new modern steam generating station, prime movers to be condensing steam turbines connected to a.c. alternators 2,000 kw. capacity each, boilers to be water tube 5,000 h.p. capacity equipped with mechanical stokers, fed by up-to-date coal

SIEMENS BROS. DYNAMO WORKS | SIEMENS BROS. & CO.

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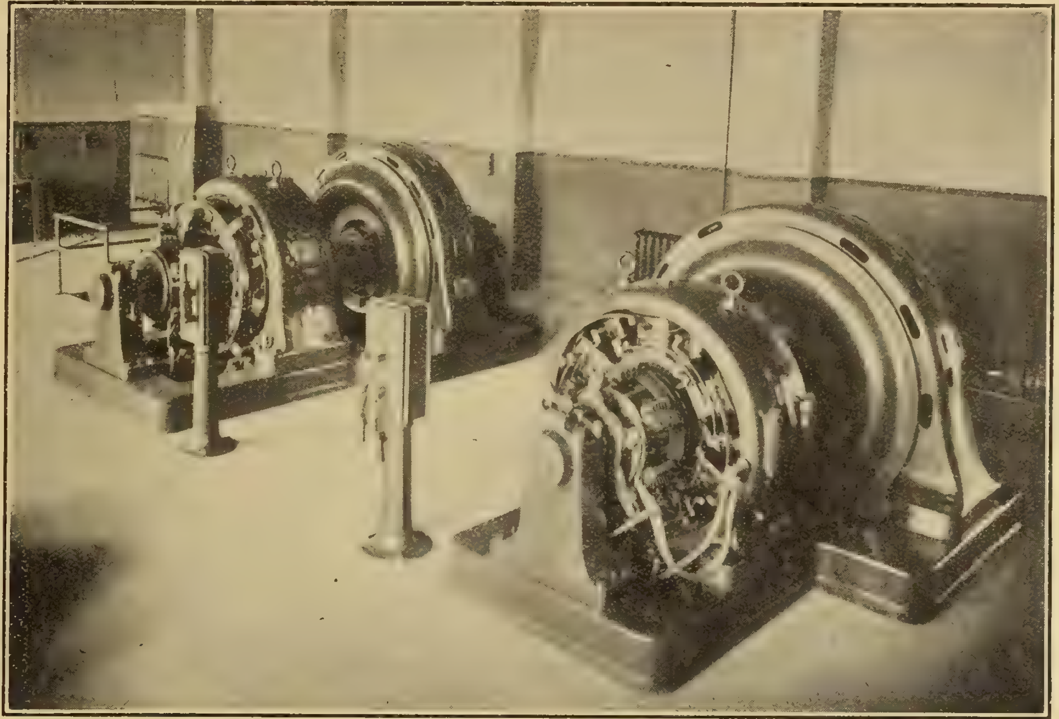


One 400 K.W. and one 200 K.W. Siemens Self Starting Synchronous Motor Generators, supplied and installed for the City of Lethbridge

We have delivered or on order in Canada amongst others the following motor generators :—

1-800 K.W. Dominion Coal Co., N.S.
1-800 K.W. Canadian Collieries, B.C.
1-700 K.W. Canadian Collieries, B.C.
2-500 K.W. Winnipeg
2-500 K.W. Port Arthur
1-400 K.W. Lethbridge
1-250 K.W, Canada Sugar Refinery Co.
1-220 K.W. Dominion Coal Co., N.S.
1-200 K.W. Lethbridge
1-100 K.W. Northern Ontario Light & Power Co.
2- 70 K.W. Winnipeg Technical Schools
1- 70 K.W. Canada Motor Co., Winnipeg
1- 50 K.W. Medicine Hat

Siemens Company of Canada, Limited

HEAD OFFICE:
Transportation Building - MONTREAL

BRANCH OFFICES:

STANDARD BANK BUILDING
TORONTO

McARTHUR BUILDING
WINNIPEG

handling machinery. Electrical superintendent, Mr. R. Wright.

Pelham Centre, Ont.

A committee has been appointed to canvass the surrounding sections with a view to determining the amount of light and power load that could be obtained if the Hydro line were run to this point.

Regina, Sask.

A by-law was submitted on June 12th, authorizing the operation on Sundays of the Regina municipal railway system.

Russel, Man.

A by-law was passed recently to expend $18,000 on an electric lighting plant.

Sherbrooke, Que.

The Sherbrooke Railway & Power Company have requested the city to revise the contract made three years ago in regard to the route of the car lines. Owing to the growth of the city the company state that to meet the requirements of the contract certain changes not previously contemplated will have to be made.

St. Thomas, Ont.

The St. Thomas Biscuit Company will install 150 h.p. in motor capacity and will require all auxiliary equipment.

The Western Ontario Electric Company has been incorporated with head office, St. Thomas.

St. John, N.B.

A contract has been awarded to the W. O'Leary Company, Montreal, for the installation of an electric lighting system in the Cathedral of the Immaculate Conception.

Sorel, P.Q.

The council has under consideration the installation of an electric fire alarm system.

Saskatoon, Sask.

Fifteen by-laws were recently voted on by the ratepayers of Saskatoon, and not only did every by-law carry by a large majority, but there was not a single ward in which an adverse vote was accorded on any one of the by-laws. Street car and electric light extensions were among the most favorably received.

On a recommendation of Superintendent Edward Hanson, the council has awarded the contract for the supply of steel for street railway extensions to the Canadian Steel Foundries, Limited.

Sunderland, Ont.

A by-law was carried on May 22nd, to authorize the expenditure of $5,800 on a hydro-electric distribution plant.

Tweed, Ont.

A by-law will be submitted to the electors on June 16, authorizing an agreement between the village of Tweed and Tweed Electric Light & Power Company, Limited. The company agree to erect a plant and supply energy for light and power in the village. The household lighting rate is to be 9c per kw. hour. The street lighting will include fifty 40 watt tungsten lamps and forty 60 watt tungsten lamps, for which a yearly rate of $970 shall be paid.

Toronto, Ont.

H. M. Queen Mary, on June 3rd, opened the Sanitorium for Consumptives at Weston, Ont. Her majesty closed an electric circuit at Buckingham Palace, London, which was directly connected, by means of the Commercial Cable and C. P. R. telegraph systems, to electrical equipment in the hospital. The connections between the land line of the cable system were by means of the invention of Mr. Gott, recently described in the Electrical News. An acknowledgement of the signal was telegraphed directly to Buckingham Palace.

A report will be made to council by Messrs. R. A. Ross, consulting engineer, Montreal, Bion J. Arnold, New York, and J. W. Moyes, Toronto, on the value of the property of the Toronto Electric Light Company and the Toronto Railway Company.

The Hydro-electric Power Commission of Ontario will prepare estimates on the cost of an electric railway line connecting the city of Toronto with the towns lying northeasterly, including Markham, Stouffville, Port Perry, Uxbridge, etc.

The city has commenced work on the road-bed for the Terauley street railway line, which will connect up with the Anderson and St. Patrick line. This is part of the Toronto Railway Company's system.

Vernon, B.C.

The corporation of the city of Vernon, B.C., are spending, during the present year, some $85,000 on their generation, distribution and lighting system. $50,000 of this is for an additional oil engine and generator, and $8,000 for ornamental street lighting. The municipality, with a view to popularising the use of electric ranges, are supplying these to their customers on a monthly instalment basis.

Vancouver, B.C.

The North Coast Electric Company, Limited, has been incorporated with head office Vancouver.

Welland, Ont.

Mr. C. J. Laughlin, vice-president of the Nigara, Welland and Lake Erie Electric Railway Company has stated that the extension of the street railway system to Dain would be undertaken within a very short time and completed by September 1st.

The Electric Steel and Metals Company, Limited, has been incorporated to carry on business as an engineering supplies and construction company, railway, civil, mining and electrical engineers, etc., with head office at Welland.

Estimates have been prepared on the cost of placing the wires underground. The cost of 6,000 ft. of four duct construction was placed by the engineer at $16,500.

Winnipeg, Man.

Commissioner Robson has handed down a judgment in the matter of overhead electric distribution in the municipality of Kildonan. The commissioner advocates the joint use of electric poles. This matter affects principally the Winnipeg municipal system and the Winnipeg Electric Railway Company.

Tenders are called till June 30th, for 240 ornamental street lighting standards.

Yorkton, Sask.

A by-law will be submitted to the electors on June 20th, authorizing the expenditure of $140,000 for extending the present plant of the town and for distribution for light, heat and power purposes.

Personal

Mr. Frank E. Filer has been appointed manager of the Winnipeg office of the Packard Electric Company.

Mr. Herbert C. Barber has joined the sales staff of the Packard Electric Company, with headquarters at Toronto.

Amongst the recent orders secured by the Packard Electric Company are the following: City of Edmonton, four 1000 kv.a., 60 cycle, oil-insulated, self-cooled, 3-phase, 13000 volt transformers; City of Calgary, three 150 kv.a., 60 cycle, oil-insulated, self-cooled transformers; City of Winnipeg, six 100 kv.a., 60 cycle, oil-insulated, self-cooled, 12000 volt transformers.

The field of illuminating engineering is as yet too narrow to develop men who have not some commercial affiliation. Practically every real lighting expert is employed by one or another manufacturer of lighting equipment and is, therefore bound by loyalty to recommend the product of the organization which he serves.

While the manufacturer's expert is prejudiced, it must be remembered that he does his best. He strives honestly and unselfishly to show how to secure the best possible lighting results from the goods made by his factory. His recommendations are the best he can devise, for the products his company makes. The value of his service, therefore, is not measured so much by his ability as by the variety and quality of the product he has to work with.

The Holophane experts are bound by loyalty to no particular type of equipment, for the Holophane line embraces "a reflector for every service." This statement is not a boast but a literal fact. The Holophane line contains Reflectors of all materials, all types, all finishes.

You are at liberty to ask for the advice of these specialists at any time. There is no charge. Their recommendations will be plain, accurate, and honest. For the Holophane expert is as nearly as possible an expert without prejudice. His only restriction is quality, he has nothing cheap or shoddy to offer. He is ready to serve you. Requests will be promptly and accurately handled.

Condensed Department

Publisher's Notice

Advertisements under "Situation Wanted" "Situation Vacant" or Miscellaneous, are charged at 2 cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., are charged at $2.10 per inch.

All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure insertion in the subsequent issue.

Wanted

Catalogues and correspondence from manufacturers and supply houses of everything electrical. Star Electric Co., 27 Court St. South, Port Arthur, Ont. 12

Wanted

WANTED—Second-hand generators. 1—60 kw., 1—150 kw., 1—120 kw., 1—200 kw., 3 phase, 60 cycle, 2200 volt machines, for belt drive, must be in good condition and by some standard maker. Box 780, Electrical News, Toronto, Ont. 9-12

Car Ventilating Systems

The Cooke System of Mechanical Car Ventilation. Specifications and estimates furnished. Manufactured in Canada under Canadian Patent 128070. Vacuum Car Ventilating Co., 561 W. Monroe Street, Chicago, Ill. 11 t.f.

The proprietors of Letters Patent No. 127080 relating to "Process of Manufacturing Iron Electrodes for use in Alkaline Accumulators" and No. 127081 relating to "Active Masses for Positive Electrodes of Electric Elements, etc.," desire to dispose of the Patents or to grant Licenses to interested parties at reasonable terms with a view to the adequate working of the Patents in Canada. Inquiries to be addressed to the actual proprietors, Svenska Ackumulator Aktiebolaget Jungner, Stockholm, Sweden. 12

FOR SALE

125 Direct Current Jandus enclosed arc lamps for 110 Volt circuit, complete with opal inner globes and porcelain shades. These lamps have been used in our Department store, and will be sold at $6.00 each, Winnipeg.

We will sell the lot or any part at this price.

The T. EATON Co., LTD.,
Engineers' Department,
Winnipeg, Man.

12-13

Electric Motors For Sale

Following Canadian General direct current compound wound motors.

One 15 h.p. 750 r.p.m.
One 10 h.p. 800 r.p.m.
Two 7½ h.p. 1000 r.p.m.
One 3 h.p. 1200 r.p.m.
All 500 Volts.

All nearly new. Sliding bases, automatic rheostats. Complete with pulleys and switches. Bargain for quick sale. Apply, The Metallic Roofing Company, Limited, Toronto. 12

For Rent—Cottages

If you want a real holiday, plan to spend your vacation this year in Muskoka where "the breezy call of incense breathing morn" will put new life in mind and body. Muskoka offers more real healthful enjoyment for less money than any other resort in the world.

Four cottages to rent $125 to $200 on Bohemia Island, less than a mile from Royal Muskoka Hotel and good Golf Links. Box 771,

Electrical News, Toronto Ont.

Situations Wanted

Young man, 22, four years experience in charge small plant, desires position as superintendent's assistant in power plant. Engineer's certificate for Saskatchewan and good general knowledge of electrical work. Box 800, Electrical News, Toronto, Ont. 11-12

Telephone Engineer having ten years experience in engineering, Toll, Telegraph, Testing and Special Equipment, desires position with Telephone Company, Railroad Company or Consulting Engineer. Scotch. Age 32. Married. Self-educated. Box 164, Electrical News, Board of Trade, Montreal, Que. 12-13

Commercial Engineer (A.M.I.E.E); electrical and mechanical; practical, technical and commercial training and experience; 29 years of age, Scotch nationality; previous Canadian experience; author of well-known engineers' reference book, now in Toronto, desires position with plenty of scope and good prospects. Good salesman, correspondent and organizer. Box 815, Electrical News, Toronto, Ont. 12

MOONLIGHT SCHEDULE FOR JULY, 1913

Courtesy of the National Carbon Company, Cleveland.

Date.	Light.	Date.	Extinguish.	No. of Hours
July 1	8 00	July 2	3 50	7 50
2	8 00	3	3 50	7 50
3	8 00	4	3 50	7 50
4	8 00	5	3 50	7 50
5	8 00	6	3 50	7 50
6	8 00	7	3 50	7 50
7	8 00	8	3 50	7 50
8	8 00	9	3 50	7 50
9	8 00	10	3 50	7 50
10	8 00	11	4 00	8 00
11	10 20	12	4 00	5 40
12	10 50	13	4 00	5 10
13	11 30	14	4 00	4 30
15	0 10	15	4 00	3 50
16	1 10	16	4 00	2 50
17	No Light	17	No Light	
18	No Light	18	No Light	
19	7 50	19	10 10	2 20
20	7 50	20	10 30	2 40
21	7 50	21	10 50	3 00
22	7 50	22	11 10	3 20
23	7 50	23	11 30	3 40
24	7 50	24	11 50	4 00
25	7 50	26	0 10	4 20
26	7 50	27	0 30	4 40
27	7 50	28	1 10	5 20
28	7 50	29	1 50	6 00
29	7 40	30	2 40	7 00
30	7 40	31	3 40	8 00
31	7 40	Aug 1	4 10	8 30

Total Hours............163 20

IRON HOUR SERVICE

Do you realize that Simplex supremacy has come from its years of reliable service,
That this company has sold SERVICE, not guarantees?
That its great success has not developed from printer's ink; but from meritorious product?
Do you know that the faith in the integrity of electric heating devices is based on years of service given by Simplex products?
If you realize that our best references are those who have used Simplex irons for ten years or more in their business—who have used their equipment 30,000 hours and more—you can understand the value of

SIMPLEX ELECTRIC HEATING COMPANY

Mfrs. of everything for Electric Cooking and Heating

BELLEVILLE, ONT.
CHICAGO, 15 S. Desplaines St. CAMBRIDGE, MASS.
SAN FRANCISCO, 612 Howard St.

The new range booklet will bring you business.

SIMPLEX QUALITY

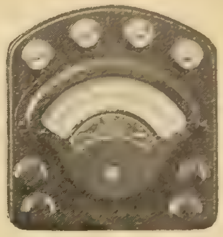
Tenders

A few dollars spent in advertising your proposals in

The Contract Record

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

Model 280, Single Range Portable Voltmeter.
(One-quarter size.)



Model 280, Triple Range Portable Volt-Ammeter.
(One-quarter size.)

WESTON

Miniature Precision Instruments for Direct Current

A new group of very small Indicating Instruments.

COMPACT—ACCURATE—DURABLE—BEAUTIFUL

PORTABLE

Voltmeters, Millivoltmeters, Volt-Ammeters, Ammeters, Mil-Ammeters are supplied in single, double and triple ranges.

The Volt-Ammeter comprising six instruments in one.

This group also includes BATTERY TESTERS.

SWITCHBOARD

Voltmeters Volt-Ammeters Ammeters Mil-Ammeters

This new line of instruments represents the latest development of the pivoted moving coil, permanent magnet type for low ranges.

The refinement of design and mechanical work in them has been carried to a degree which would appear to be almost impossible of accomplishment, if the results were not evident in the instruments themselves.

They embody characteristics which have made the well known Weston Standards famous throughout the world.

They are accurate, dead beat and extremely sensitive.

They may be left continuously in circuit at full load without injury and are shielded against the external electrical and magnetic influences of other apparatus in their vicinity.

They are substantially constructed and may be safely sent long distances through the mails and will withstand an extraordinary amount of vibration without injury.

They have the longest scale ever provided in instruments with equal length of pointer.

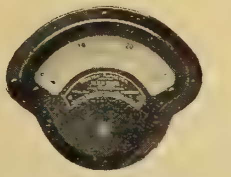
Each model has been thoroughly tested under the most severe conditions of service and in experiments extending over more than one year.

The portable instruments may be conveniently carried in the coat pocket.

The prices have been established upon so low a scale that any one may possess one or more of these remarkable instruments at moderate cost.

If you cannot obtain the instrument desired from your dealer, write us.

The several models and ranges offer a selection from over 300 different combinations, listed in Bulletin No. 8. Will be mailed upon request.



Model 267, Switchboard Ammeter.
(One-quarter size.)

Model 268, Switchboard Volt Ammeter. Reads Amperes. Press Button for Volts.
(One-quarter Size.)

WESTON ELECTRICAL INSTRUMENT COMPANY,

Main Office and Works:
NEWARK, N. J.

New York, 114 Liberty St.
Chicago, 1504 Monadnock Block
Boston, 176 Federal Street.
Philadelphia, 342 Mint Arcade.
Birmingham, Brown Marx Bldg.

St. Louis, 915 Olice Street.
Denver, 221 15th Street.
San Francisco, 682 Mission St.
Cleveland, 1729 E. 12th Street.
Detroit, 44 Buhl Block.

Montreal, Winnipeg, Vancouver, Calgary — Northern Electric & Mfg. Co.
Toronto, 76 Bay Street.
Paris, 12 Rue St. Georges.

London, Audrey House, Ely Place, Holborn.
Berlin, Genest Str. 5, Schoenberg.
Johannesburg, So. Africa, F. Peabody Rice, Standard Bank Buildings, Harrison Street.

Nº115

BANNER
TRADE MARK.

Artistic and Attractive Designs in

Lighting Fixtures

"Banner" Electric Fixtures embody al the popular and most up-to-date designs together with many of our exclusive creations.

Write us for an estimate on your next job.

We specialize on making fixtures from original drawings on short notice.

"Banner" Fixtures

MADE BY

Nº30014

Ontario Lantern & Lamp Co., Limited,

HAMILTON, CANADA.

Double Circuit 33,000-Volt 3-Phase Crossing

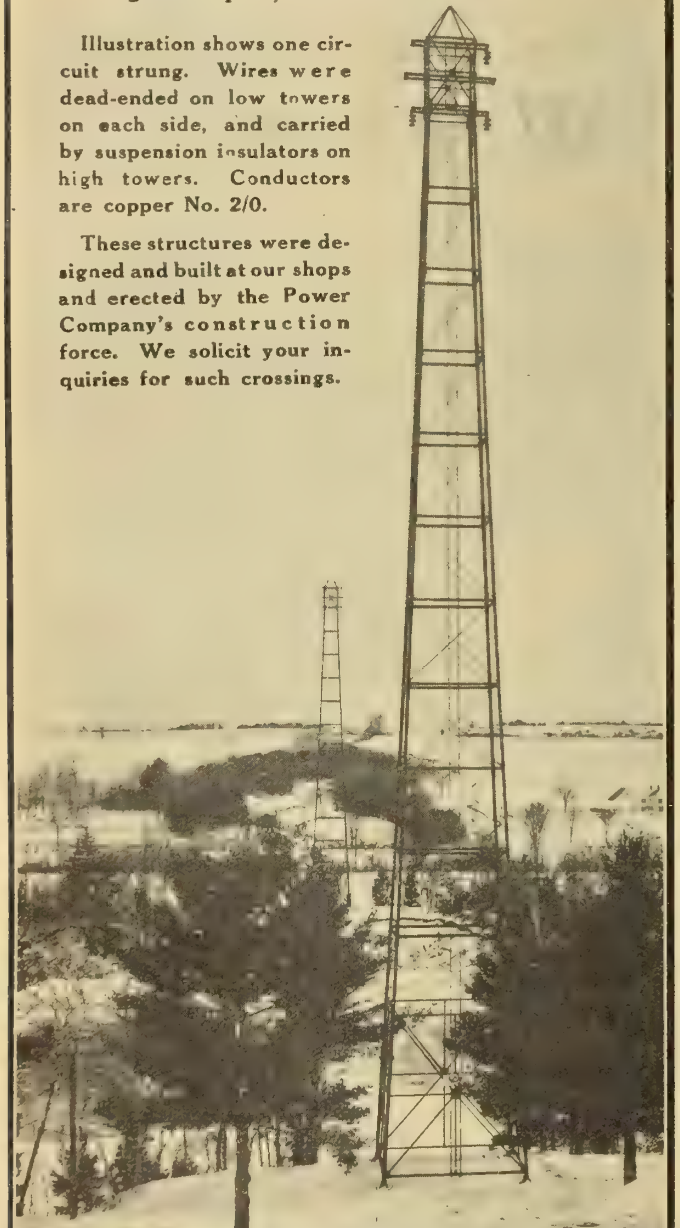
of the Central Maine Power Co., over the Kennebec River at Farmingdale, near Augusta, Maine.

Towers carry wire over main ship channel, with minimum clearance of 160 feet over water at high tide.

Height of towers, 169 feet; 20 feet square at base. Main members, 6x6 angles. Span, about 800 feet.

Illustration shows one circuit strung. Wires were dead-ended on low towers on each side, and carried by suspension insulators on high towers. Conductors are copper No. 2/0.

These structures were designed and built at our shops and erected by the Power Company's construction force. We solicit your inquiries for such crossings.

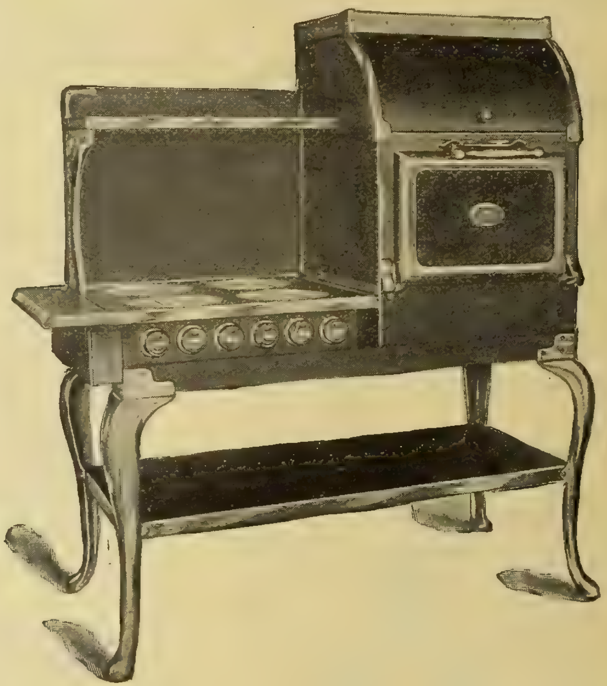


Archbold-Brady Co.

Syracuse, N. Y.

Gas and Coal Ranges Have Been Removed From Several Hundred Homes in Winnipeg—and Hughes Electric Ranges Have Been Installed Instead.

This is the largest installation of Electric Ranges in any city in the world.



In these hundreds of homes food is prepared in the new and modern way. The old fashioned methods, with dirt, soot, bother, delay, discomfort and dangers incident to flame cooking, are done away with.

The season is at hand when the demand is greatest for Electric Stoves.

Write for catalogue and discounts

Hughes Electric Heating Co.

902 Home Street, Winnipeg

Main Office and Factory: Chicago

WE MANUFACTURE AND INSTALL

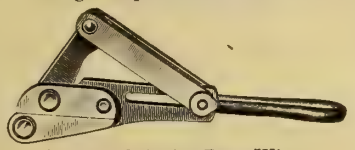
TALKING ELECTRIC SIGNS
STANDARD " " " "
SPECTACULAR " " "
FLASHERS & CARRIAGE CALLS

The Electric Carriage Call & Specialty Co. 311 W. 40th St., NEW YORK, U.S.A.

M. KLEIN & SONS.

Parallel Screw Clamp.

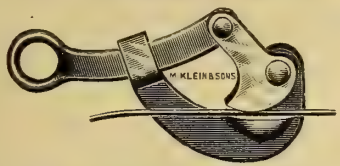
Chicago Grip for Insulated Wire.



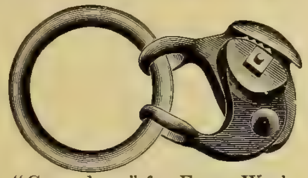
Chicago Grip for Bare Wire.

M. KLEIN & SONS.

Quick Samson Grip for Guy Wire.



Havens Grip for All Around Work.



"Comealong" for Fence Work.

WIRE GRIPS FOR EVERY JOB

If you require tools for line work turn to KLEIN.
Here we display a few wire grips covering a range from trolley to fence wire, and every type is doing service throughout the world.

Klein Tools Have Wired the Earth

and these grips were employed in the work.

Klein Products

are carried by the leading Electrical Supply and Hardware merchants.
Write us for a catalogue, then order from your most convenient source of supply.

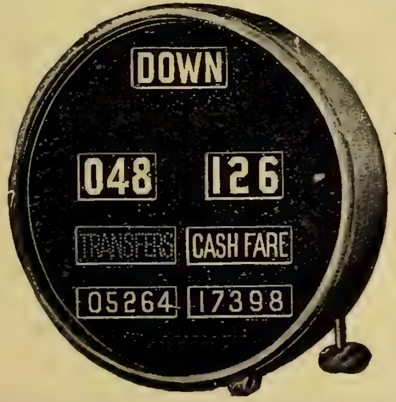
Mathias Klein & Sons
Canal Station 59
Chicago, Ill.

Tenders Wanted

should be advertised for in the "Tenders and For Sale Department" of the CONTRACT RECORD AND ENGINEERING REVIEW. This paper is the "Tender Ad." medium of Canada and always brings bids from the reliable contractors and supply houses.

File your plans for any work on which you are inviting bids, in our offices at Toronto, Montreal, Winnipeg or Vancouver.

Contract Record
and Engineering Review
Toronto Ontario



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represents more than twenty-five years experience in Register manufacturing, and the present types are the best designed, the most strongly built, and the simplest and most reliable Registers on the market.
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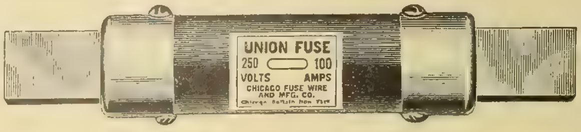

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don't wait until it's necessary to use several pounds of cure.

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The Pipe

GREENFIELDUCT

of Quality

INTERIOR
is Hot Galvanized.
A Smooth Zinc
Finish is obtained
by a Patented
Wiping Process.
Then Treated
with Enamel.

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Zinc Finish is
obtained by a
Patented Wiping
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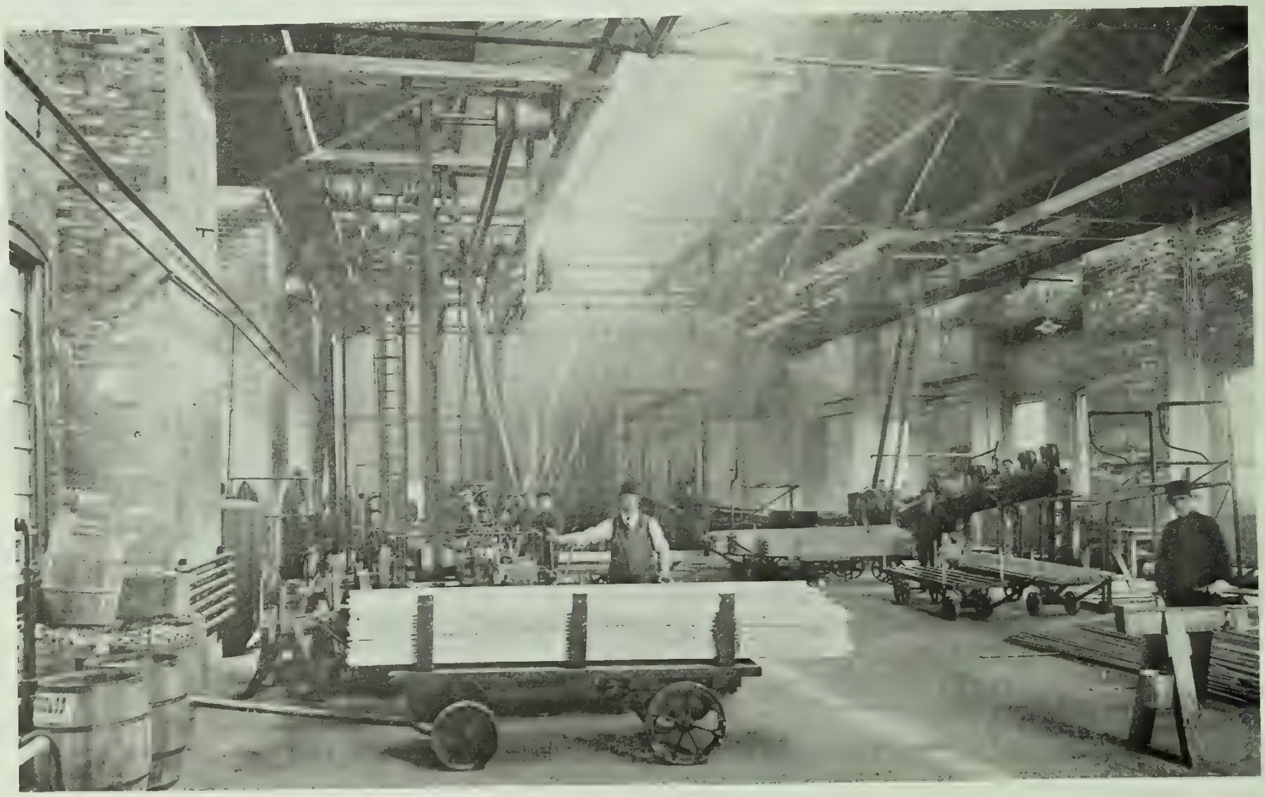
The Home of Greenfield Conduit



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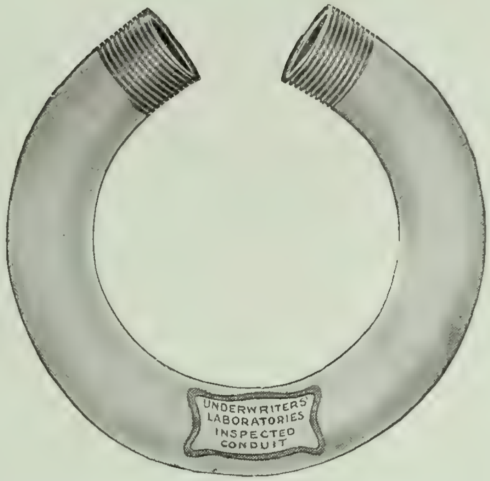
INTERIOR AND EXTERIOR



HOT GALVANIZED

GREENFIELDUCT

is a HOT GALVANIZED CONDUIT, both the EXTERIOR and the INTERIOR SURFACES being treated by a PATENTED HOT GALVANIZED PROCESS. Molten Zinc is wiped over these surfaces in such a manner as to produce a PERFECTLY SMOOTH FINISH and a HOMOGENEOUS COATING OF ZINC throughout.

THREADED ENDS OF

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are clean and well cut, and insure a rapid coupling.

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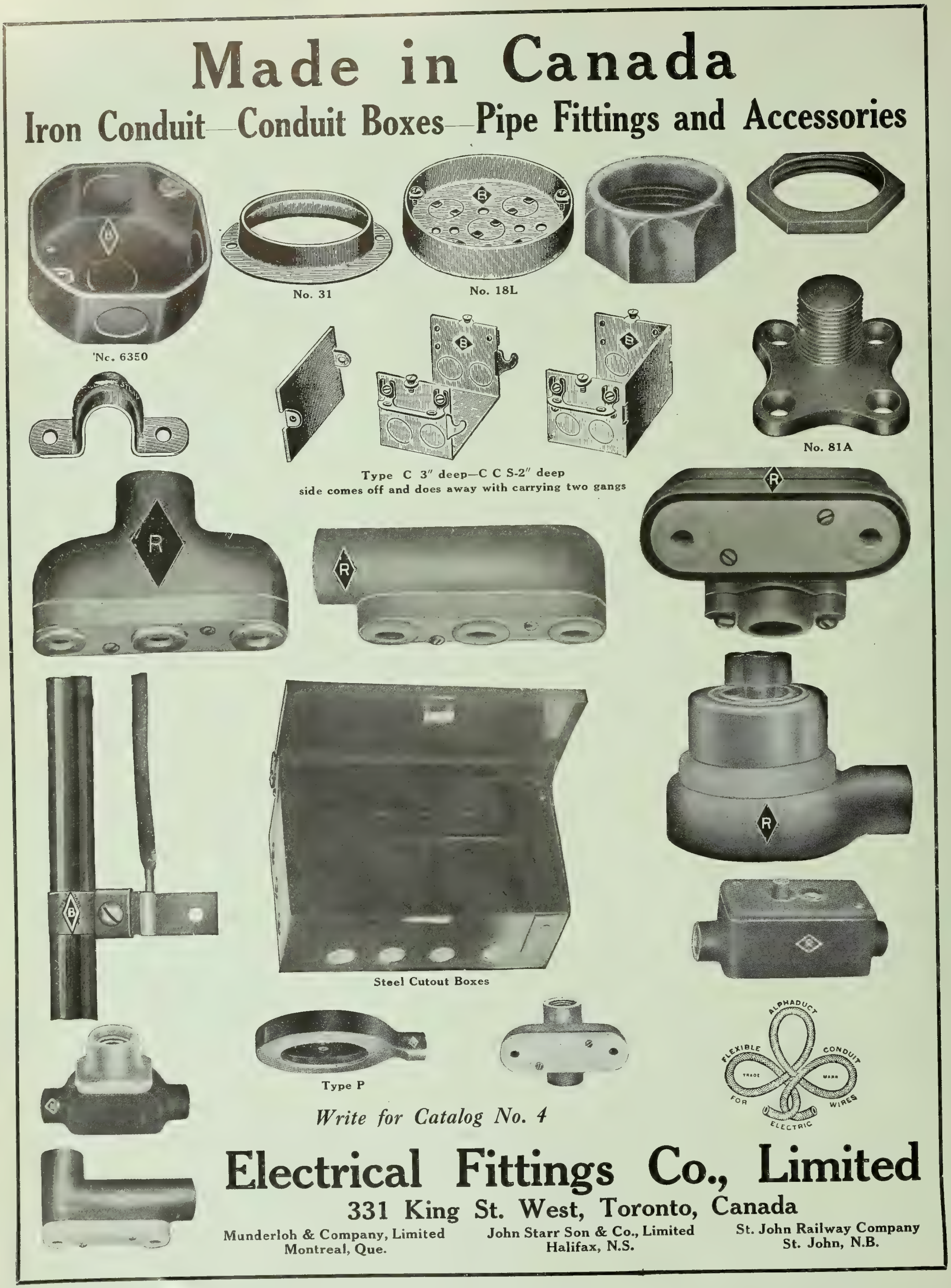

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No. 6350

No. 31

No. 18L

No. 81A

Type C 3″ deep—C C S-2″ deep
side comes off and does away with carrying two gangs

Steel Cutout Boxes

Type P

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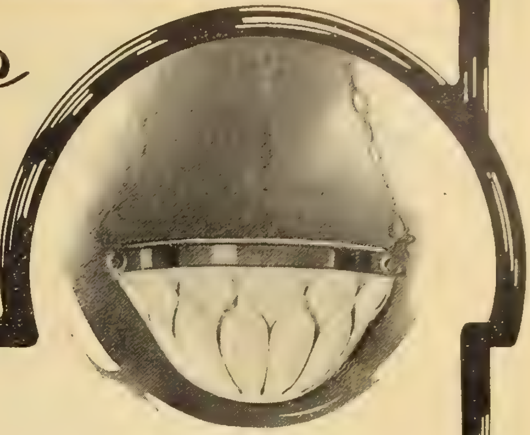

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FEATURE Delica White—not because of its splendid reputation—but because of the qualities that have made this reputation possible.

¶ *It is loaded to the guards with salability.*

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It has every element of a strong seller

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¶ Money will not buy a better or more popular glassware, yet *the price you are paying for the ordinary kind will buy Delica White.* You want the best your money will buy.

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Representative

We can keep you running
while we make your repairs

Fred. Thomson Co., Limited

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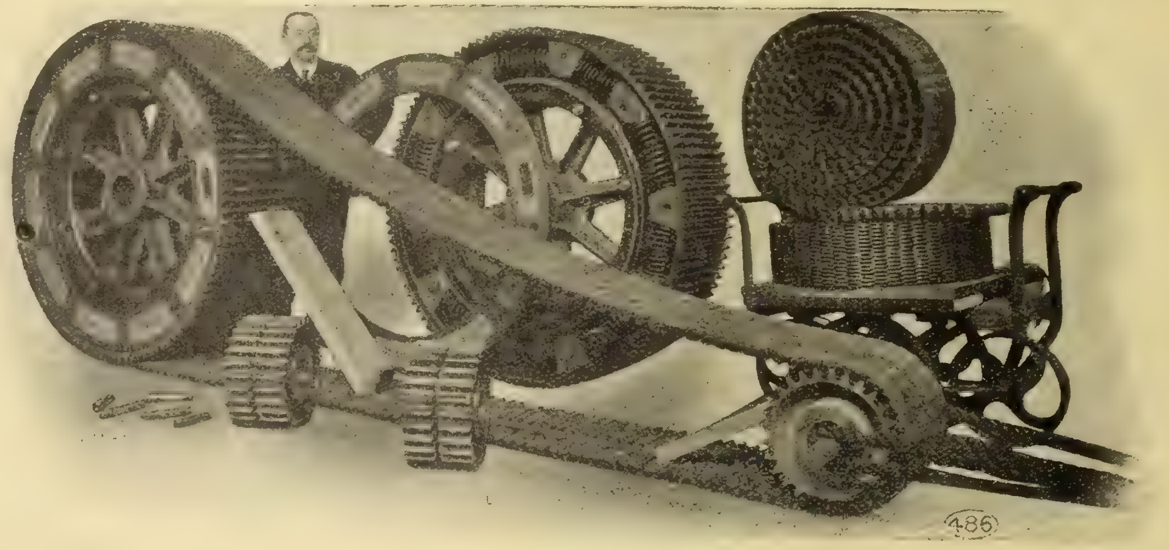
Drives we installed in a prominent Canadian Manufacturing plant in 1908. Repeat orders from the same company are the best indications of satisfaction



Each of these drives transmit 200 H. P. (from Electric Motors). The duty is exceptionally severe and load is pulsating, necessitating spring wheels. They have been running 4 years night and day without repair of any kind, with exception of a new spring.

Pinions 28T., 15¾ ins. diam., 286 R. P. M. Spring wheel 108T., 60 ins. diam., 74 R.P.M.
Chains, 2 on each drive 1¾ pitch, each 8 ins. wide. 70,000 lbs. breaking load. Chain speed 1170 F.P.M.

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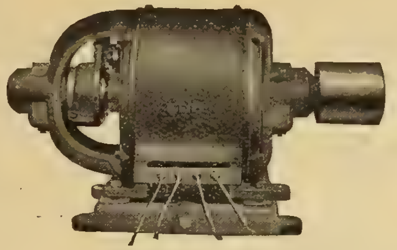
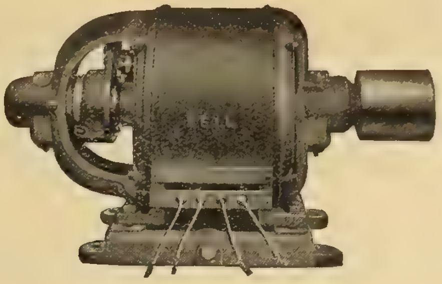
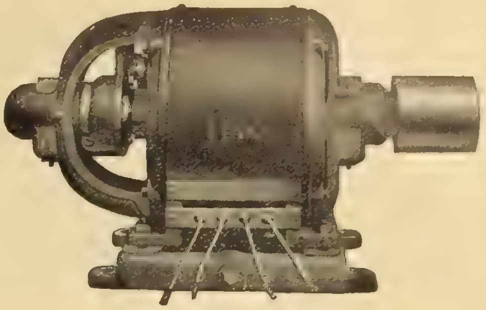
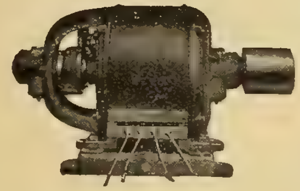
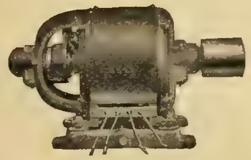
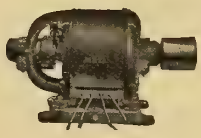
We stock Chain and Repairs

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They embody every improvement essential to a perfect motor—automatic in operation—no compensators—no clutch—wound for interchangeable voltage—bronze bearings and large steel shafts.

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Garwood, N. J., U. S. A.

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The experience gained in thousands of installations under widely varying conditions in all parts of the world insures to you reliability and rugged mechanical construction, which means so much in the operation of condensing apparatus.

We guarantee to maintain a vacuum as close to absolute as is commercially possible to produce; this with an operating cost and maintenance lower than any other system on the market.

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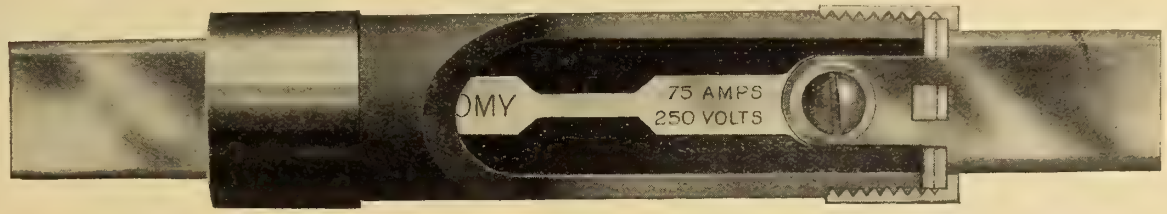

"Look for the Gray Shell"

And for These Reasons:

First, of course, because it provides a practical method of reducing the fuse maintenance expense more than 80%.

Second, because it is the only renewable fuse that is uniformly rated.

Third, because it is the only design so far produced that provides the desired electrical characteristics.

Fourth, because all capacities of renewal elements are readily available, making large stocks of fuses unnecessary.

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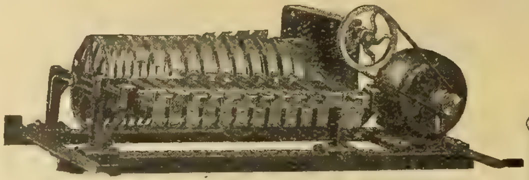

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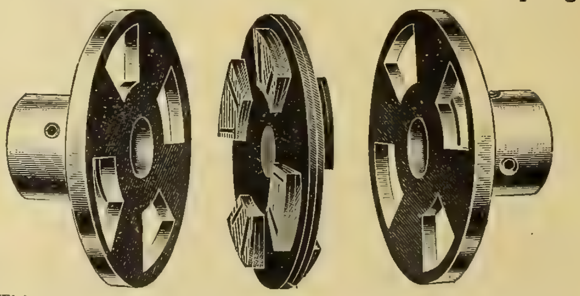
CLEVELAND ARMATURE WORKS, Cleveland, Ohio

The Grundy Patent Flexible Insulated Coupling



This coupling really insulates and adapts itself to drives in which shafts are not well aligned. It is highly powerful, absolutely positive and silent. Runs either way. Practically indestructible and needs no repairs. Specify the Grundy Flexible Insulated Coupling. Details and prices are ready for you. Write.

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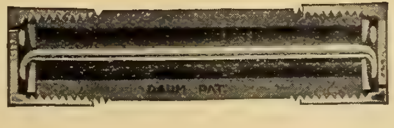

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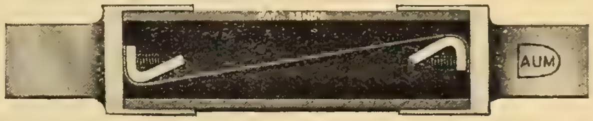

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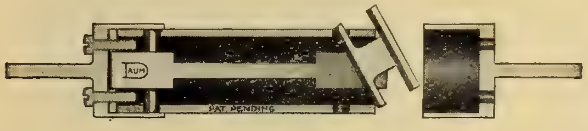

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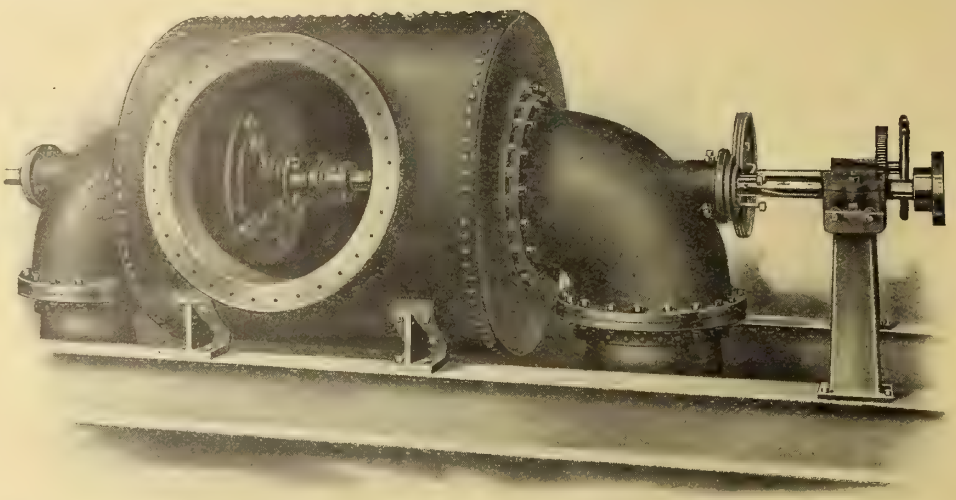
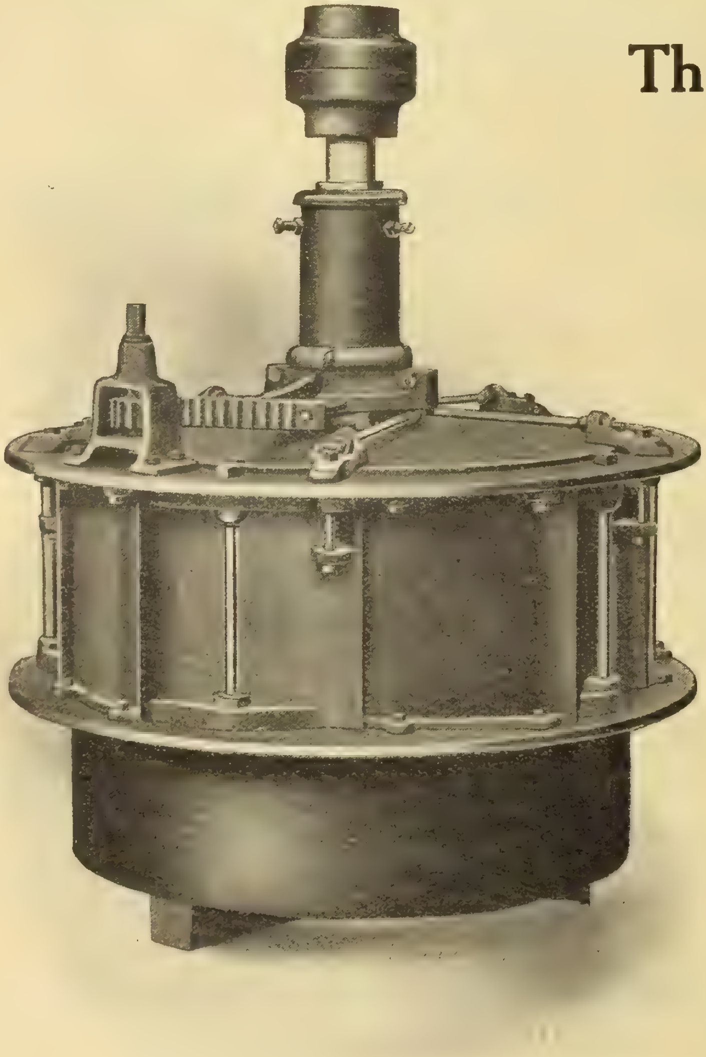
CONSERVE THE WATER POWERS
TRADE MARK.

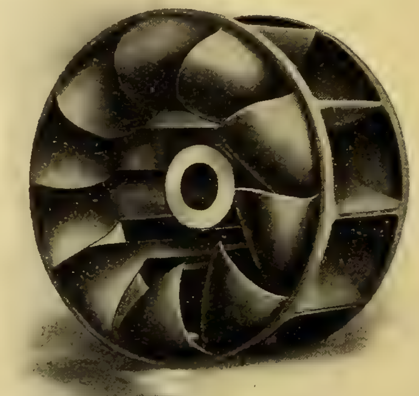
Canadian Design.
Unexcelled Efficiency.
Simple Construction.
Great Durability.



The Canadian Turbine Water Wheel

Normal in Speed, Normal in Discharge,
—Hence—
Greatest Range of High Efficiency under all Working Conditions.
The Turbine That Always Gives Satisfaction.





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Water Power Equipment only.

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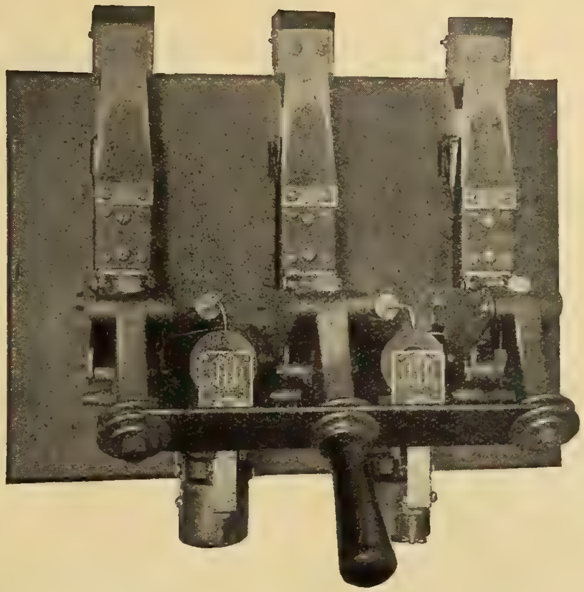
is a sturdy piece of apparatus, but staunch though it is there are many exigencies of service from which it should be given such protection as can best be secured by the use of a properly chosen

I-T-E Circuit Beaker



The Type "W," three pole, Time Limit (DALITE) Circuit Breaker shown herewith is admirably adopted to the protection of induction motors operating under a wide variety of conditions. This form, together with others covering practically the entire range of industrial service, is described in our new

HAND BOOK OF THE I-T-E CIRCUIT BREAKER

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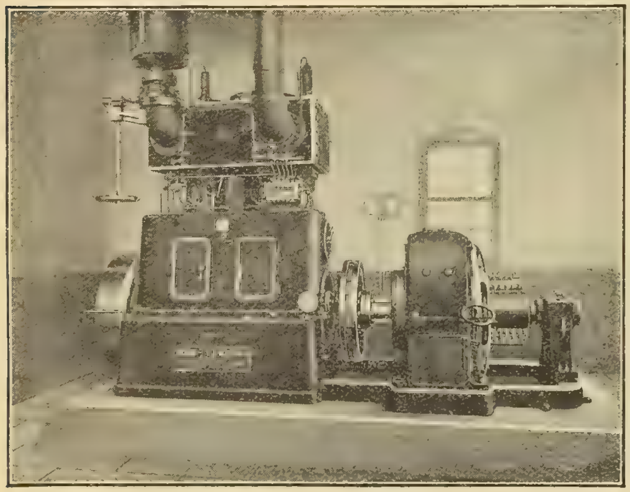

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They Like

VALVES outside because accessible.

POSITIVE LUBRICATION because bearings require practically no attention for months.

COMPLETE ENCLOSURE OF PARTS because of the protection it affords.

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RESULTS of D-P BATTERY & AUTOMATIC REVERSIBLE BOOSTER INSTALLED IN A CENTRAL POWER STATION.

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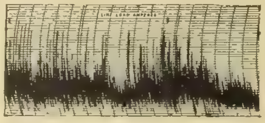
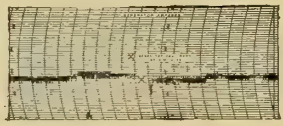


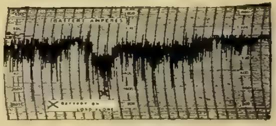
Line Load amperes.

Generator Load. Fluctuation, 15 amperes either side of mean.



Generator amperes.

Battery Load, being difference between line and generator.



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ESTABLISHED 1888. CODE: A B C, 5th EDITION. CONTRACTORS TO ADMIRALTY AND WAR OFFICE.

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are particularly adapted for mill service. They are positively waterproof, are proof against all tampering, and are so constructed as to avoid all danger in making connections. They automatically break the circuit when opened. Fitted with Outlet Hooks for Conduit connection.

Boxes for 250 volt D. C. current

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Incorporated 1911
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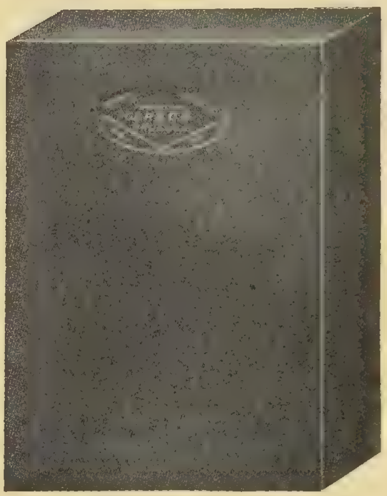

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CERTAIN, DEFINITE BRUSH RESISTANCE
depending upon the design of the motor or generator. Further—
A Definite Degree of Abrasiveness Is Necessary in Brushes
to keep the mica insulation of the commutator flush with the copper segments.

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Brushes
are classified in an entirely new way which makes it easy to select the brush best suited to your service. We classify brushes with respect to voltage, current density, resistance per cubic inch and abrasiveness—the latter under seven divisions.

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Galvanized and Painted
STEEL STRUCTURES of every description
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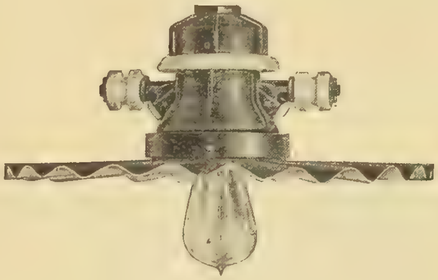
Brockville
Harriston
Paris
Ridgetown

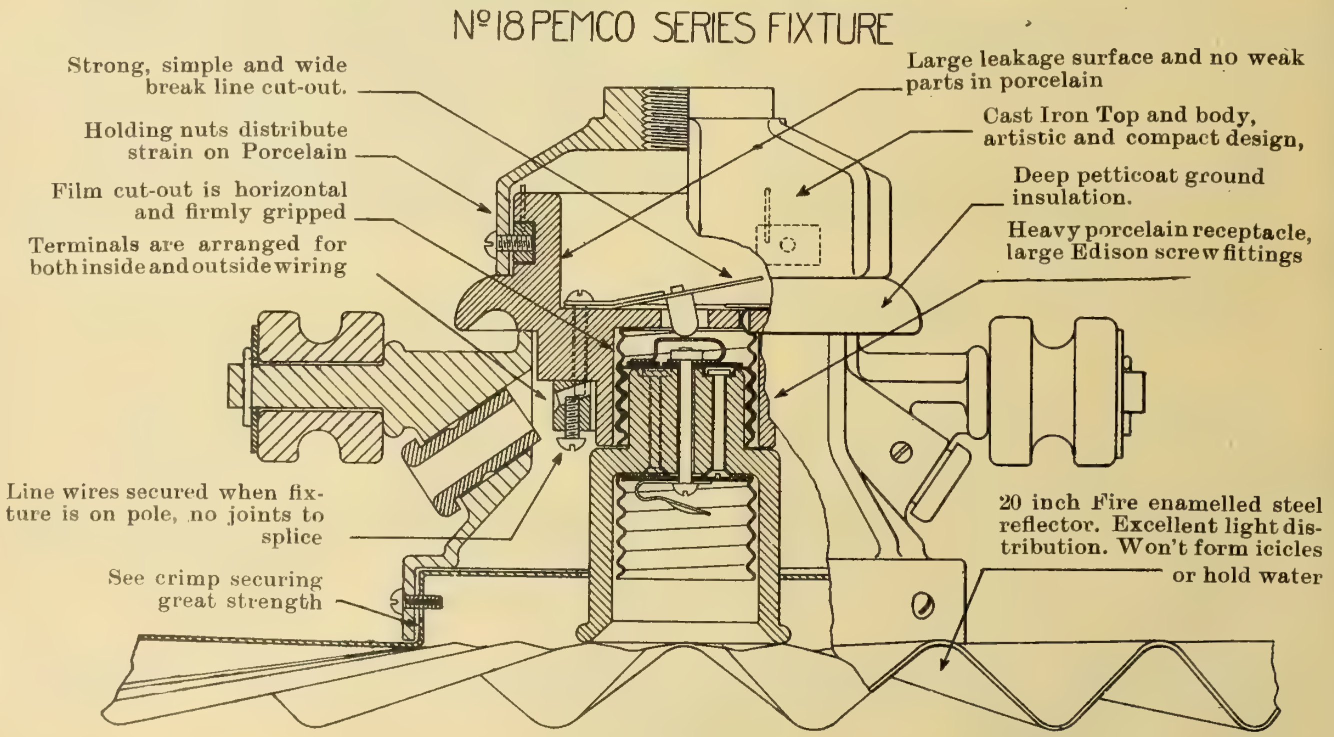
Write Canadian Representative for copy of Bulletin No. 7



Fixture No. 18.

Fixture No. 20.

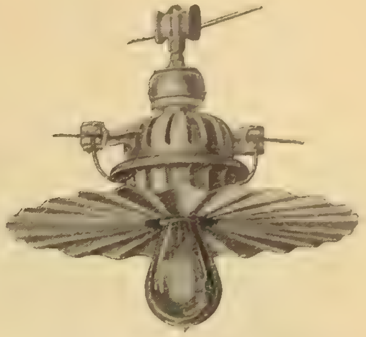
Sectional View Pemco Series Street Fixture


Nº18 PEMCO SERIES FIXTURE
Strong, simple and wide break line cut-out.
Holding nuts distribute strain on Porcelain
Film cut-out is horizontal and firmly gripped
Terminals are arranged for both inside and outside wiring
Line wires secured when fixture is on pole, no joints to splice
See crimp securing great strength
Large leakage surface and no weak parts in porcelain
Cast Iron Top and body, artistic and compact design,
Deep petticoat ground insulation.
Heavy porcelain receptacle, large Edison screw fittings
20 inch Fire enamelled steel reflector. Excellent light distribution. Won't form icicles or hold water

Philadelphia Electric and Mfg. Company

CANADIAN REPRESENTATIVE: **A. H. WINTER JOYNER, Limited, 76 Bay St., Toronto**

We Have Waited Two Years to



Style G—One-Piece Fluted Streethood

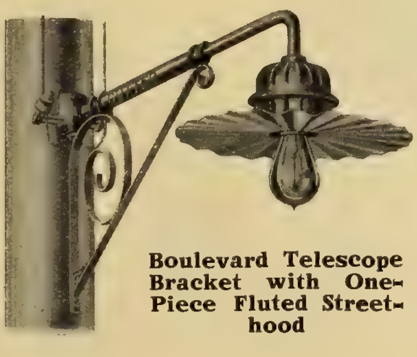
Tell You This

Write for Catalogue 12

We had to **perfect** our new type, one-piece, fluted street hoods, before we could offer them to users demanding the best at a price that is reasonable. It's a matter of principle with us. We have staked our reputation of 24 years on them—they are our masterpieces. For substantial construction, high insulation, easy installation and artistic appearance, see that your next order for streethoods specifies

Cutter Streethoods

Style G shown above is a center span suspension, with the famous Cutter Cable Clamp—the choice for years of careful buyers. This artistic streethood has a reinforced porcelain insulator designed to receive series or multiple sockets. The Boulevard Telescope Bracket shown below is one of dozens of sturdy convenient brackets, fitted with one-piece fluted streethoods, comprising our big popular line. Every fluted steel reflector is fire enameled—blue on top and white on the strong reflecting surface. In service, price and appearance, Cutter Streethoods will satisfy **YOU.**

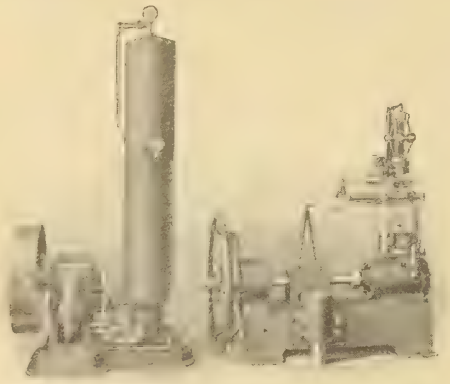


Boulevard Telescope Bracket with One-Piece Fluted Streethood

Before you make your next extension or change, write for our latest catalog, number 12. Packed from cover to cover with just the things you want to know about streethoods, arc fixtures and brackets, mast arms, ornamental posts, mazda arcs, wiring devices, etc. Hundreds of live men say our latest book is "great." YOU will too. YOUR copy is waiting for you here. Write—right N-O-W.

GEORGE CUTTER COMPANY

423 Notre Dame St., SOUTH BEND, INDIANA, U.S.A.



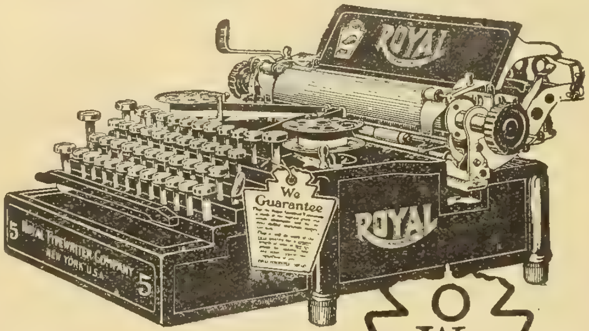
THE GOVERNOR FOR YOUR CONDITIONS

We are specialists in the manufacture and application of hydraulic governing apparatus.

The knowledge and the shop equipment which enable us to build the 250,000 ft. lb. governors for the Mississippi River Power Co. at Keokuk, are at the command of the purchaser of any of our governors.

WHAT IS YOUR PROBLEM?

THE LOMBARD GOVERNOR CO. ASHLAND, MASS.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We Guarantee
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ROYAL TYPEWRITER COMPANY NEW YORK U.S.A.
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That the Royal Standard Typewriter is made of the highest grade materials obtainable and by the most skillful workmen money can hire,

That it will do work of the best quality for a greater length of time at less expense for upkeep than any other typewriter, regardless of price.

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Special keys for electrical expressions furnished FREE.

Attractive terms for the electrical Fraternity.

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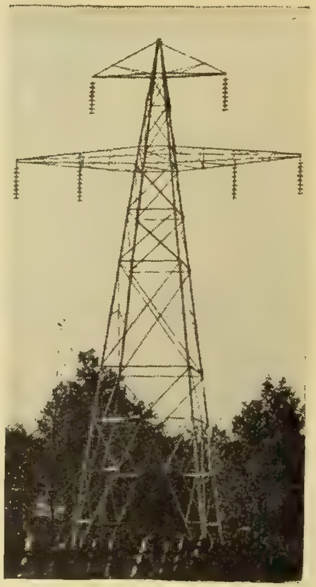

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One of 3,300 Towers furnished for the 300 mile Transmission Line of the Hydro Electric Power Commission of Ontario Transmitting a 110,000 volt current from NIAGARA FALL to the principal cities of ONTARIO. The largest single order of Transmission Towers ever placed

Hot Galvanized or Painted

Estimates furnished on application

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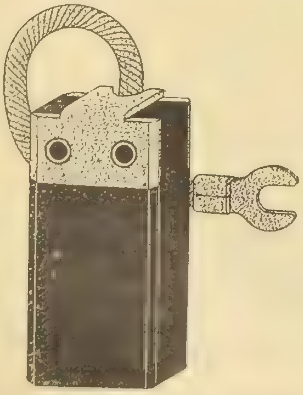
100 per cent Carbon Brush Efficiency



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REDUCE Commutator Repairs
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Every Brush sold under an absolute guarantee.
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Why experiment.
A TRIAL ORDER will convince.
Samples gladly sent

Le Valley Vitae Carbon Brush Company
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4 Forms—1 Result—The Perfect Joint

Efficiency is the word. Let us co-operate with you to increase the efficiency of your service. Use Yager's Fluxes in any of the four convenient forms — Salts—Stick—Paste — Fluid, to produce joints which will not fail you at the critical moment. No acid in any of them. They make the perfect electrical joint.

Write now for sample and discount.

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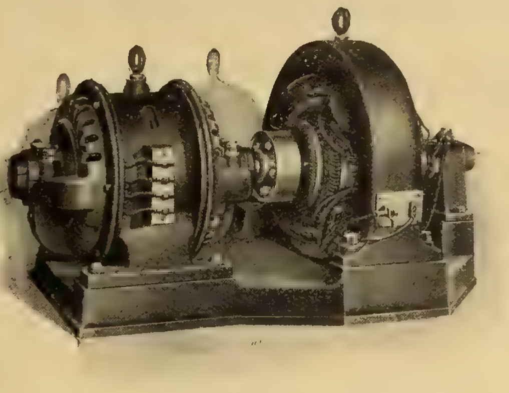
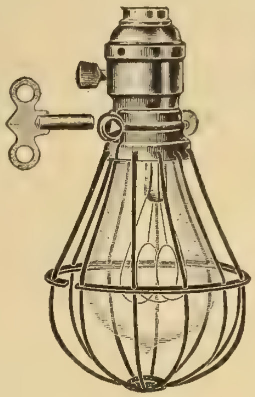


Such as are manufactured by

Toronto & Hamilton Electric Company
HAMILTON

Have you any repairs? Write us.

The Two Fold Protective Feature Makes it of Double Value



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"Double Service at Single Cost"

is the slogan of the Loxon. It protects expensive Mazda and Carbon Lamps against Breakage and Theft at one and the same time-- thus saves buying separate protective devices.

YOU GET FULL VALUE -- when you buy Loxons—Insist on protecting your lamps with Loxons.

Carried by Most Canadian Electrical Dealers.
Quantity Prices and 1913 Catalog of Full Line on request.

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Halt!

ever consider that proper glassware was necessary for Successful Street Lighting

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ALABASTER HALF OPAL
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Globes made according to specifications

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Makers of all kinds of Illuminating Glassware
Pressed Colored Roughed Etched
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Panel Boards
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combine
HIGH QUALITY
with
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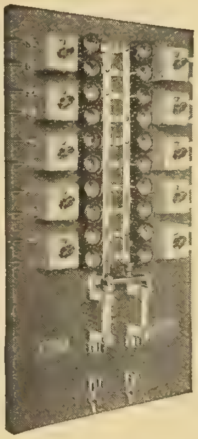

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Use our Same-Day-Received Quotation Service.

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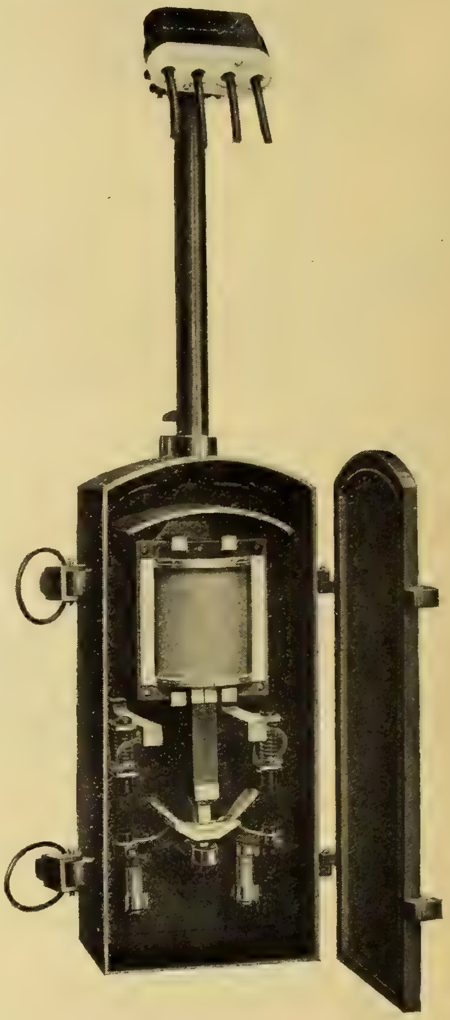
The Modern Method of Street Lighting and our Remote Control Solenoid Switches, Type 17 H.E.P.

are inseparable. One is not complete without the other.

These switches are not an experiment. **Look at the cuts,** note the **simplicity** of construction, the **straight line design, no** springs or swivels or other complicated or uncertain mechanisms.



They close magnetically and are opened by gravity assisted by the tension of the laminated copper contact. **All arcing is taken up on the carbons.** The consumption is low and they run cool and noiselessly.

But you don't need to take our word for it. The Hydro Electric Commission have adopted them, have been using them right along, and are still sending in orders. The list of towns looks like a directory of the Province of Ontario. The Western Provinces are well represented too. **Get into line, you engineers and power companies.** Don't waste wire, transformers, cross arms and time but simplify your system by ordering our **Type 17 H.E.P. Solenoid Switches,** for any frequency on multiple circuit or D. C. Series circuit.

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Limited

162 West Adelaide St., Toronto

Phones Adelaide 902
" 903
Nights, Sundays and Holidays Beach 1723
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Paiste Refillable "Fusette Fuse Plugs" List Now at 7c.

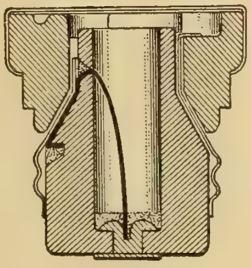
Mica Cap holder--a permanent investment.

The "Fusette" — a porcelain core containing the fuse strip. This only is wasted when a fuse blows.

The price of our two-piece fuse plug complete has now been made 7c. list.

The price of the porcelain core—the Fusette which contains the fuse is 5c. list.

You save the difference every time a fuse blows—saving 29%



Sectional view showing Fusette in holder. Note the good contact of fuse with shell of holder.

When a fuse blows take the old Fusette from holder and slip in a new one—only the Fusette is wasted, the holder is as good as ever.

As your present fuse plugs blow out replace them with Fusette Fuse Plugs. They are "approved," of course for 125 volt work.

Neatest–Easiest Wired Paiste Molding Taplets

No soldering required, no extra insulation, no grooving of the molding to fit joints. The taplets cover rough ends of moldings. A stock of these taplets will save hours of time. Approved by the Fire Underwriters' Association.

Branch Molding Taplets—Styles for 2-wire or 3-wire or 3 to 2-wire, single or double branches.

Molding Cross Overs—For carrying new molding over old molding—no extra insulation necessary. Styles for 2 or 3-wire.

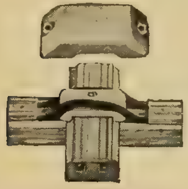
Molding Connectors—Meeting Fire Underwriters' requirement for approved filling for end splices. Styles for 2 or 3-wire.

Angle Molding Taplet—For side wall branch from ceiling main wires coming through the wall. Styles for 2 or 3-wire.

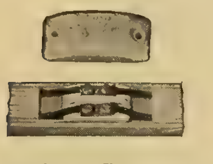
Corner Molding Taplet—For branch made with corner from feed wires in same room or coming through the wall.

Order these Taplets from your jobber or write to us for samples and description.

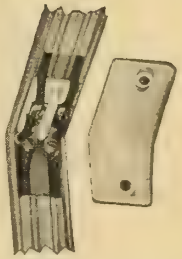
Branch Molding Taplet



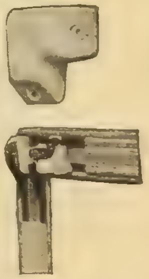
Molding Cross Over



Molding Connector



Angle Taplet



Corner Taplet

H. T. Paiste Co.

Philadelphia
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Samson Water Wheels

The Samson wheel is specially adapted for direct connection to "umbrella type" or vertical shaft generators.

A special feature of our wheels is the conical shaped dome, which gives a strong and solid support for the upper bearing.

The high speed of the Samson also makes it peculiarly suitable for this form of installation.

If you are ever likely to develop a water power, you'll be interested in our catalogue. May we send it?

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Yes and they last longer.

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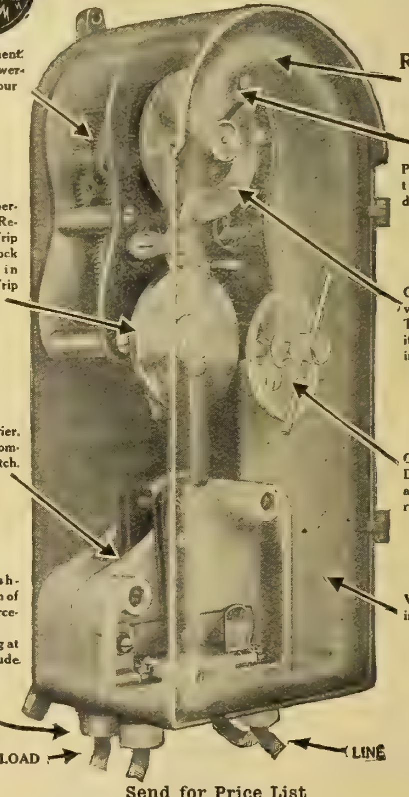
CAMPBELL TIME SWITCH

THE BEST (PATENT)



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Regulate Clock

Pointer indicates time on clock dial.

Fly wheel operates switch. Released by Trip Hands on clock dial coming in contact with Trip Lever.

Clock Dial revolves carrying Trip Hands with it. Set by loosening thumb nut.

Porcelain barrier, allows small compact knife switch.

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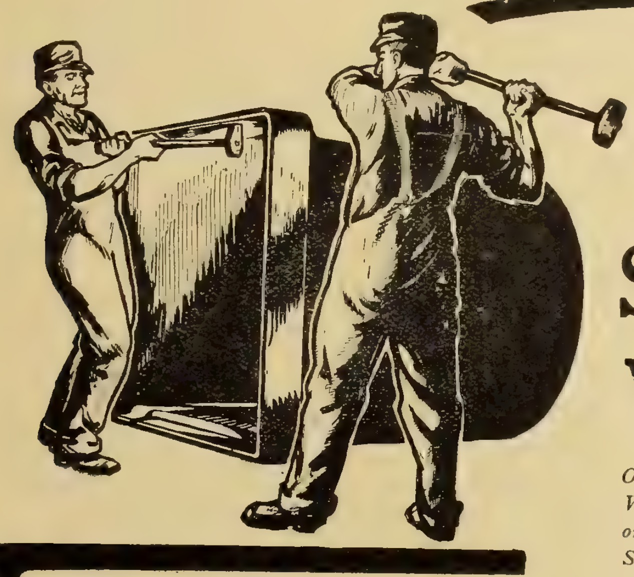

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Steel Plate Work—

Our list for general industrial use includes: Settling and Washing Tanks, Storage Bins, Cookers, Steel Plate Conveyors and Elevators, Smoke Breechings, Steel Stacks, Riveted Steel Pipe.

These are built in a separate department of our Boiler Shop which is devoted entirely to this class of work. Every job is carefully assembled before shipment, and special care is taken to see that it is not sent out until it is right in every particular. We guarantee our workmanship.

When you are next in the market, send us your sketches and let us quote—you will find our prices reasonable.

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Bank of Montreal	Winnipeg
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Standard double truck "Near-Side" car.

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Perfect ventilation and automatic heat regulation with other sanitative provisions meet the requirements of the most exacting Health boards.

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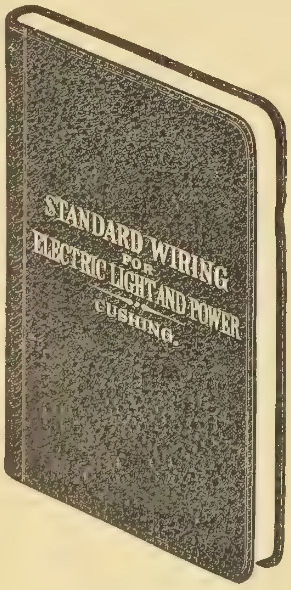

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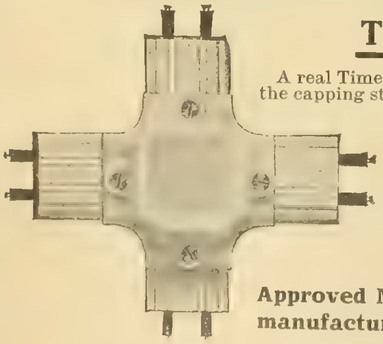

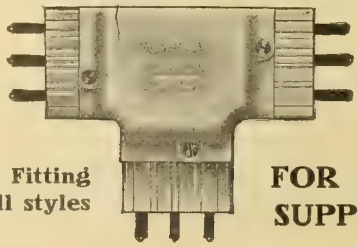

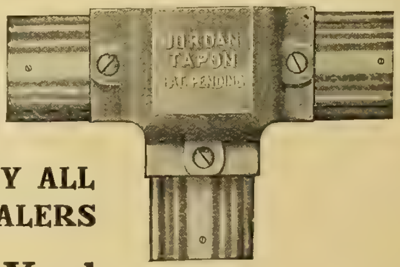

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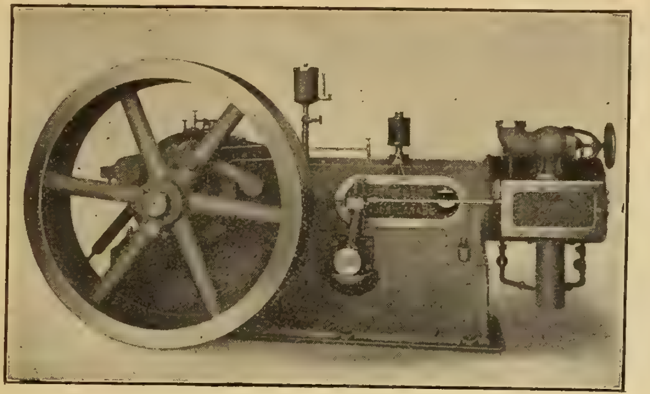

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Reflector of white porcelain enamel.

Can furnish either semaphore or plain lens.

No. 14

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Made in type to be set in dash, or to be screwed outside of dash.

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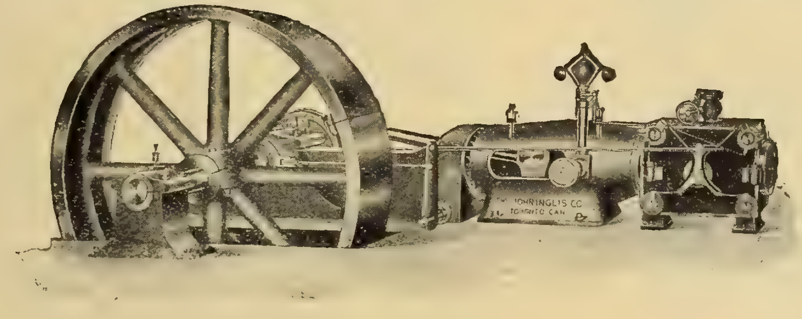

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Made in sizes of from ¼ to 40 H.P. and 25 to 140 cycles.

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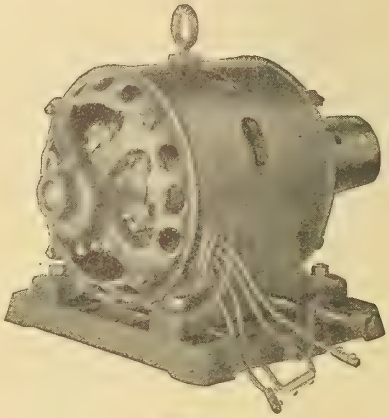

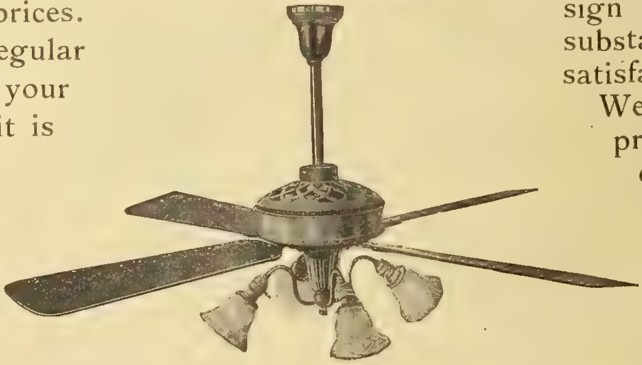

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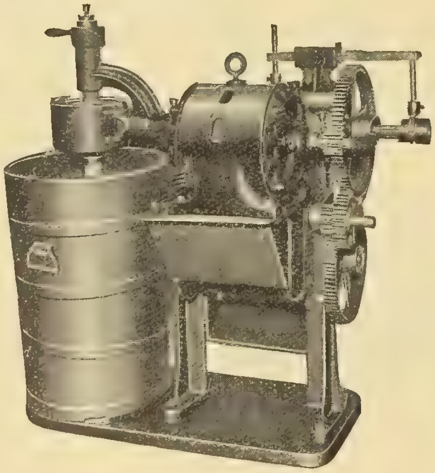

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Financial Facts on Signaling

From a financial viewpoint several Electric Railway Officials who have upon their lines G R S Automatic Block Signals have found that they are **dividend producers.**

Continuous Track Circuit Signaling, showing G.R.S. Light Signal

More Than Warranted

"In summing up our experience with this installation we can say that from the standpoint of safety to passengers and equipment and increased efficiency of the train crews, we find that the expense in equipping our line with Automatic Stop Block Signals has been **more than warranted.**"

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G R S Double Light Signal

The G.R.S. Train Dispatcher's Telephone Selector System is making remarkable service records wherever installed.

Train Dispatcher's Office Equipment at Rochester, N. Y. N. Y. C. & H. R. R.

A few figures from Rochester Division, N.Y.C. & H.R.R.R:

OPERATION

112920 calls in 200 days
565 calls per day
5 failures of all kinds
1 failure chargeable to selector

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Per Year	**16.79**

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Cumberland Valley Railroad.
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Hudson Tunnels, Hudson & Manhattan Railroad.
Indiana Union Traction Co.
Lehigh Valley Transit Railroad.
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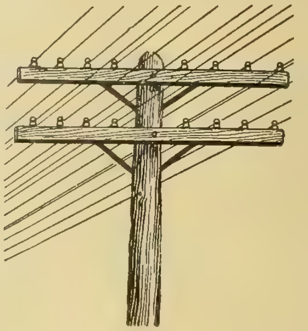

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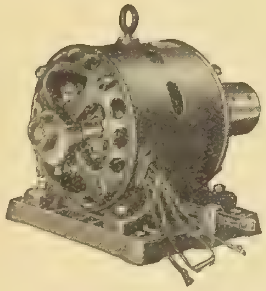

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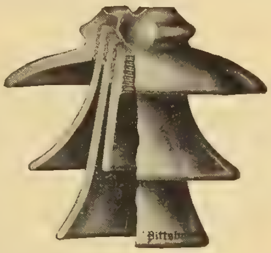

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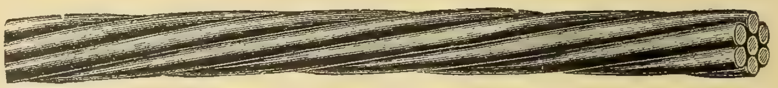

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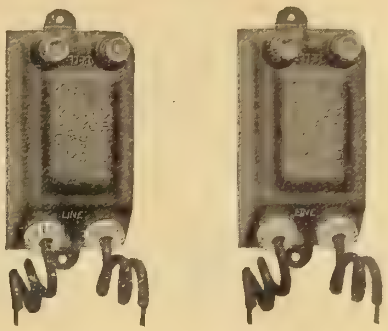

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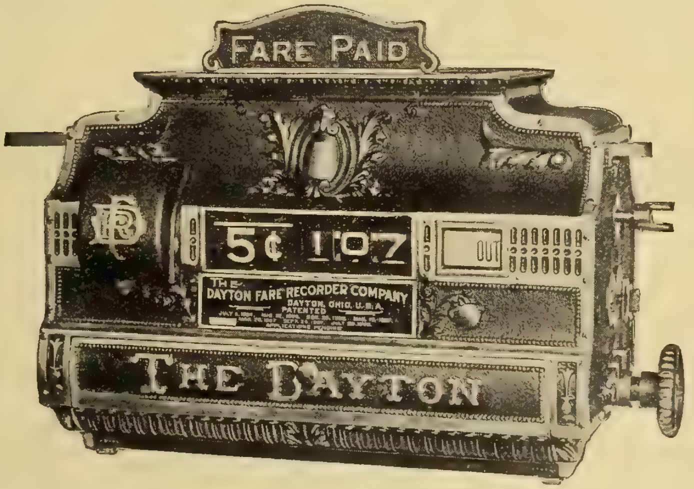

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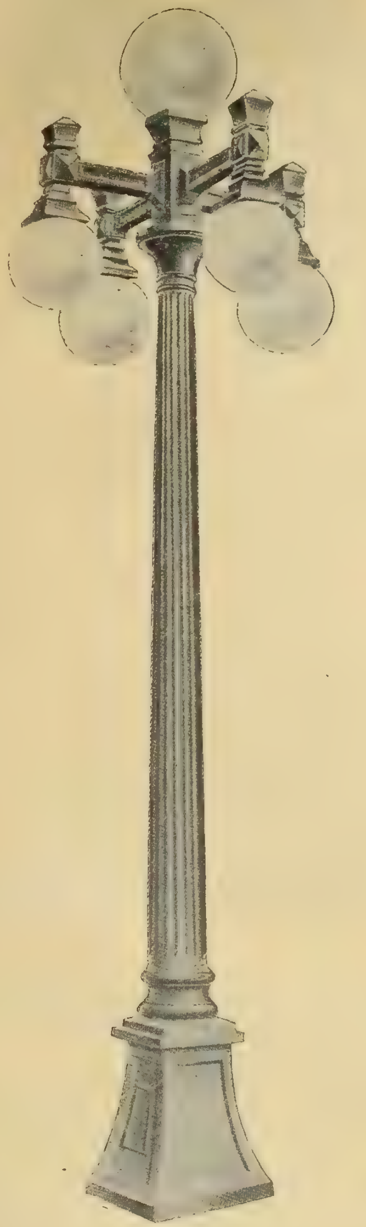

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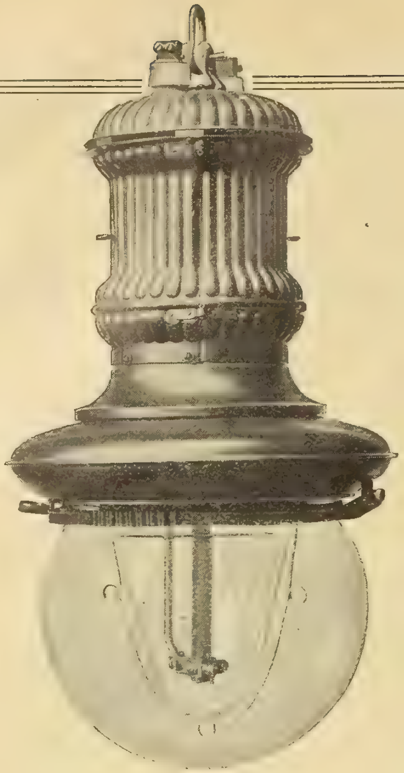

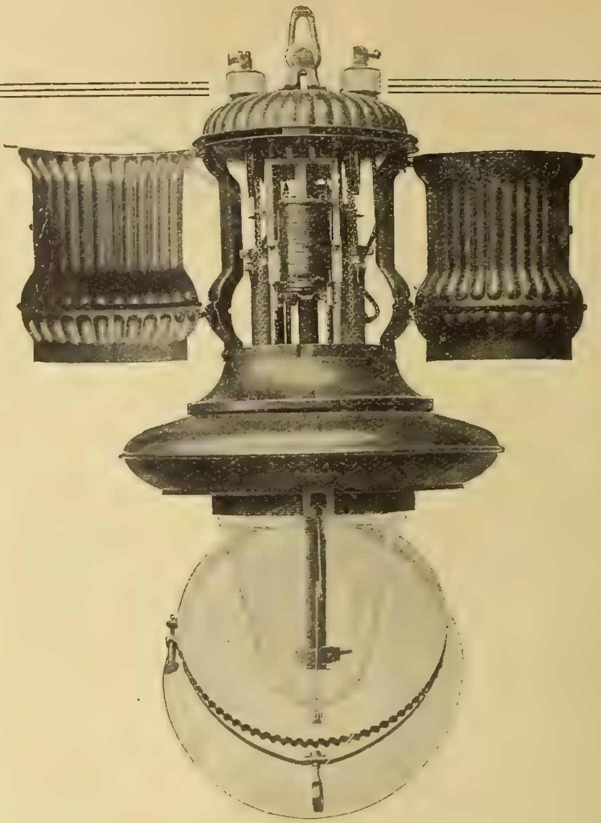

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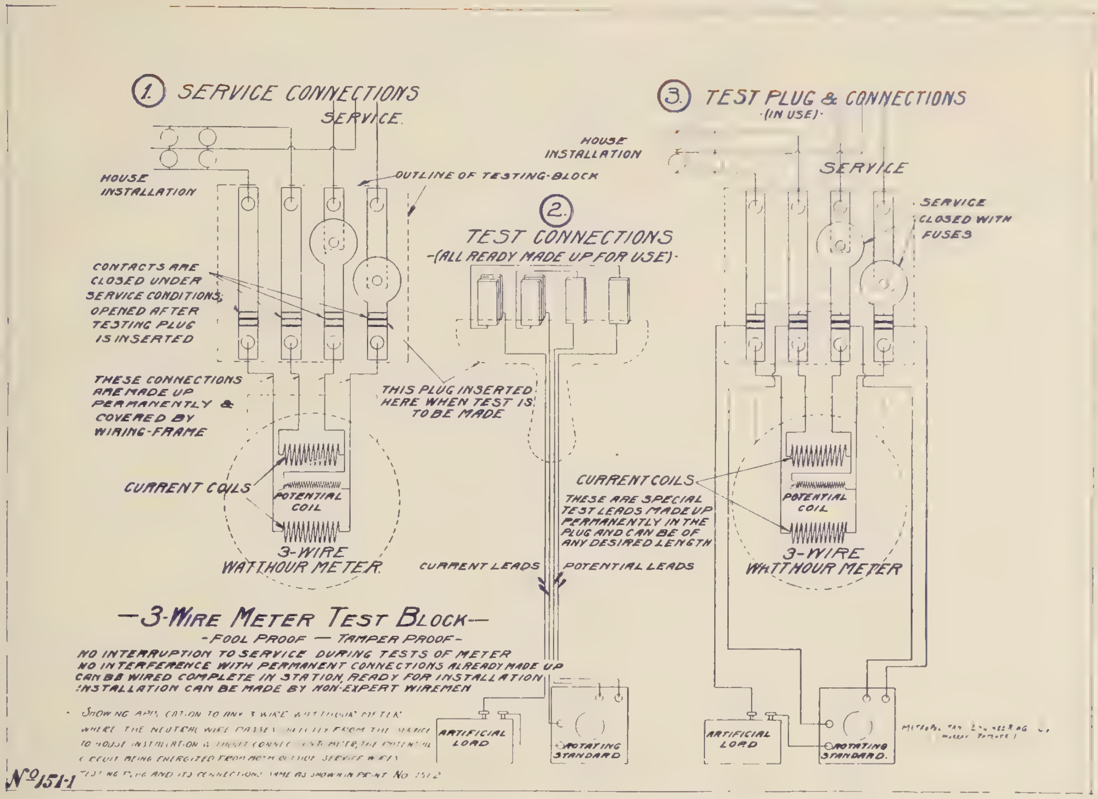
① SERVICE CONNECTIONS
SERVICE
HOUSE INSTALLATION
OUTLINE OF TESTING-BLOCK
CONTACTS ARE CLOSED UNDER SERVICE CONDITIONS; OPENED AFTER TESTING PLUG IS INSERTED
THESE CONNECTIONS ARE MADE UP PERMANENTLY & COVERED BY WIRING-FRAME
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POTENTIAL COIL
3-WIRE WATTHOUR METER
② TEST CONNECTIONS
-(ALL READY MADE UP FOR USE)-
CURRENT COILS
THESE ARE SPECIAL TEST LEADS MADE UP PERMANENTLY IN THE PLUG AND CAN BE OF ANY DESIRED LENGTH
CURRENT LEADS
POTENTIAL LEADS
③ TEST PLUG & CONNECTIONS
·(IN USE)·
HOUSE INSTALLATION
SERVICE
SERVICE CLOSED WITH FUSES
POTENTIAL COIL
3-WIRE WATTHOUR METER
—3-WIRE METER TEST BLOCK—
-FOOL PROOF — TAMPER PROOF-
NO INTERRUPTION TO SERVICE DURING TESTS OF METER
NO INTERFERENCE WITH PERMANENT CONNECTIONS ALREADY MADE UP
CAN BE WIRED COMPLETE IN STATION, READY FOR INSTALLATION
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